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内蒙古阿左旗乌兰塔塔尔地区中渐新世的林跳鼠科化石

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关键词　内蒙古　乌兰塔塔尔　中渐新世　啮齿目　林跳鼠科

内 容 提 要

本文记述的乌兰塔塔尔地区林跳鼠科化石计有中亚副蹶鼠（*Parasminthus asiae-centralis*）、党河副蹶鼠（*P. tangingoli*）、小副蹶鼠（*P. parvulus*）、邱氏戈壁蹶鼠（*Gobiosminthus qiui* gen. et sp. nov.）、？戈壁蹶鼠未定种（*Gobiosminthus* sp.）和童氏沙漠蹶鼠（*Shamosminthus tongi* gen. et sp. nov.）3 属 6 种。对副蹶鼠属各种的种内变异和种间差异、我国早第三纪林跳鼠类的系统关系以及早期林跳鼠与仓鼠间的一些形态差别做了概要的阐述和讨论。

1987 年秋，中国和德国古脊椎动物联合考察队*，根据中国科学院和德国马普学会的协议，赴内蒙古阿拉善盟阿拉善左旗的乌兰塔塔尔地区，进行了 1 个月的野外工作。考察期间，除在地表找寻和采集化石外，还筛洗了 236 袋约 10 吨土样，从中挑选出大量的啮齿类、兔形类和食虫类等小哺乳动物标本。本文是有关林跳鼠类化石的报道（其中也包含 1978 年所采少量标本）。

乌兰塔塔尔地区位于阿拉善左旗旗城巴彦浩特西北约 40 公里，该处出露一套以棕红色、棕黄色泥岩和砂质泥岩为主要岩性的沉积物，厚度超过百米。这里的哺乳动物化石最早发现于 1977 年，1978 年中国科学院古脊椎动物与古人类研究所的一支野外队做了较为仔细的寻找和采集，发现了较多的化石（黄学诗，1982），并将所获食虫类（黄学诗，1984）、梳趾鼠类（黄学诗，1985a）、偶蹄类（黄学诗，1985b）和兔形类（黄学诗，1986，1987）做了初步研究，确定其时代为中渐新世。

1978 年的野外工作，以地表拣拾为主，同时也进行了少量的挖掘。为了对含化石地层的时代有更深入的认识，中德两国科学工作者在有露头出露的 10 多平方公里内，按层位高低由东向西分了 8 个点进行筛洗，以期获得不同的化石带。但从本文研究的林跳鼠类看，难以达此目的，因为相同的种不仅存在在几乎所有的点中，而且形态变化不显，无规律可循。尽管如此，为了今后研究方便，本文仍将标本按 8 个地点分别列出，并在地点数字

* 参加本次考察的人员有：慕尼黑大学古生物研究所的法尔布施和海西希；美因兹大学古生物研究所的施密特·凯特勒；中国科学院古脊椎动物与古人类研究所的王伴月、黄学诗和刘仲云；宁夏回族自治区地质矿产局的曹景轩、张国典、陈景智和朱宝成等 10 多人。

前冠以 UTL,以示它们均属乌兰塔塔尔 (Ulantatal) 地区。还应指出的，由于部分样品已运至德国处理,及一些标本野外标签丢失,因此有少数地点 (UTL1、UTL2 和 UTL5) 化石没有收入本文研究之中。

在野外工作中,得到了宁夏回族自治区地质矿产局的大力支持；在室内研究过程中，古脊椎所的邱铸鼎、童永生、王伴月、郑绍华等先生反复观察标本，与作者进行了多次讨论,提出了许多有益的意见;在访问德国期间，慕尼黑大学古生物研究所的法尔布施教授给作者观察了欧洲的仓鼠和林跳鼠标本;此外,欧阳莲女士给标本照相，作者在此一并致谢。

一、系 统 记 述

啮齿目 Rodentia Bowdich, 1821
林跳鼠科 Zapodidae Coues, 1875
副蹶鼠属 *Parasminthus* Bohlin, 1946

该属为步林 (Bohlin,1946) 根据甘肃党河流域晚渐新世地层中发现的材料所建，包括 3 个种——中亚副蹶鼠、党河副蹶鼠和小副蹶鼠。无论是属还是种步林都未明确予以特征界定。不过根据他的描述,前两个种的差别主要在大小上,后一种与前两个种的不同不仅在大小,而且在颊齿的结构上: 后者 M^1 的后脊不与后边脊或次尖后臂相连，M^2 无原脊 II。关于副蹶鼠属的特征，按照步林的描述和乌兰塔塔尔地区新发现的材料可以归纳如下: 小到中等大小的林跳鼠类,上门齿前侧无沟,M^1 的后尖与次尖中部、后臂或后边脊相连，M^2 具 1 或 2 条原脊，M^1 和 M^2 各具 3 或 4 根。

中亚副蹶鼠 *Parasminthus asiae-centralis* Bohlin, 1946
(图版 I,1—15;图版 II,1—2;插图 1)

材料 UTL3:单个的 $M^1$4 个 (V10131.1—4);$M_3$1 个 (V10131.5)。UTL 4a:单个的 $P^4$1 个 (V10132.1); $M^1$4 个 (V10132.2—5); $M^2$3 个 (V10132.6—8); $M^3$1 个 (V 10132.9); $M_1$5 个 (V10132.10—14); $M_2$5 个 (V10132.15—19); $M_3$1 个 (V10132.20)。UTL4b: 一残破的左上颌骨附颊齿 P^4—M^1 (V10133); 单个的 $P^4$3 个 (V10133.1—3); $M^1$19 个 (V10133.4—22); $M^2$5 个 (V10133.23—27); $M^3$15 个 (V10133.28—42); $M_1$8 个 (V10133.43—50); $M_2$13 (V10133.51—63); $M_3$10 个 (V10133.64—73)。 UTL 6: $M^2$1 个 (V10134)。UTL7a: $P^4$1 个 (V10135.1); $M^1$5 个 (V10135.2—6); $M^2$5 个 (V 10135.7—11); $M_1$2 个 (V10135.12—13); $M_2$5 个 (V10135.14—18)。UTL7b: 一右上颌骨残段附颊齿 P^4-M^2 (V10136); 一左下颌骨附颊齿 M_1-M_3 (V 10136.1); 单个的 $M^1$5 个 (V10136.2—6); $M^2$3 个 (V10136.7—9); $M^3$8 个 (V10136.10—17); $M_1$5 个(V 10136.18—22); $M_2$4 个 (V10136.23—26); $M_3$15 个 (V10136.27—41)。 UTL8b: 一左下颌骨附颊齿 M_1-M_3 (V10137); 单个的 $M^1$2 个 (V10137.1—2); $M^2$2 个 (10137.3—4); $M_2$1 个 (V10137.5); $M_3$1 个 (V10137.6)。

增订特征 个体较大的一种副蹶鼠(前面的两个臼齿长皆大于 1.5 毫米)。 M^1 的后

尖与次尖后臂或后边脊相连者约占标本总数的一半，余则与次尖中部相接。M^2 具 2 条完整原脊的标本约占三分之一，余则原脊 II 短或无。前两上臼齿具 4 个齿根的标本约占三分之二，其余为 3 根或呈 3 根向 4 根过渡状态。

记述　中亚副蹶鼠这个种，步林在甘肃发现的材料仅有 4—5 块标本，7—8 个牙齿，因此很难了解它的真正性质。这次在内蒙古乌兰塔塔尔地区找到了 4 个齿列和 100 多个单个牙齿，在许多特征上呈现了变异和过渡现象，因此有必要对它们作进一步的记述和讨论。

P^4 小；成圆或椭圆形，齿冠略比齿根宽大。冠面上有一主尖（按步林说法应为后尖），高大，位于牙齿的前外侧（这在 V10136 号标本上可以看得很清楚，不象步林描述的位于前内，实际上这个种的正型标本此尖虽不靠前外，但也不靠前内，比较接近前侧）。除此尖外，冠面上有一半圆形的脊，从牙齿的后外经后内直伸到前外，与主尖之间以一半圆形的沟分开。这条弧形脊在前内端与主尖相连，经一定磨蚀后，另一端也与主尖相连。

表 1　中亚副蹶鼠的上齿列测量（单位：毫米）

Table 1　Measurements of the upper tooth-row of *Paramsminthus asiae-centralis* (in mm)

牙齿 / 标本号	P^4-M^2	P^4-M^1	M^1-M^2	P^4		M^1		M^2		M^3	
				长	宽	长	宽	长	宽	长	宽
V10133		2.45		0.75	0.80	1.75	1.50				
V10136	3.75	2.30	3.10	0.75	0.80	1.70	1.55	1.55	1.45		
T. b. 593b	4.20	2.30	3.40	0.70	0.85	1.70	1.70	1.65	1.60	1.20	1.30

注：T.b. 593b 是发现在甘肃的中亚副蹶鼠的正型标本，由步林测量。

M^1 略成矩形，长稍大于宽。在 V10136 号标本中，前壁稍宽于后壁，但在 V10133 号标本中，后壁又稍宽于前壁。其他单个牙齿，前壁宽于、窄于或等于后壁者均有之。四个主尖中，原尖和次尖在横向上比前尖和后尖稍靠前。前齿带发育程度不一，在不少标本中比较细弱（如 V10133.4）或无（如 V10133.13），在一些标本中（如 V10133.5）比较强并形成低矮的前边脊。原尖前臂变化较大，有直伸至牙齿前外角，形成（或与前边脊愈合）牙齿的前壁，前齿带弱或无（如 V10133.10），这与步林记述的甘肃标本一致；有的标本（如 V10133.15）原尖前臂虽然伸到牙齿前外角，但并不形成牙齿前壁；不少标本（如 V10133，V10132,5 等），原尖前壁短，成游离状；还有个别牙齿（V10133.5）原尖前臂与前尖前侧相接，形成原脊 I，成中华蹶鼠（*Sinosminthus*）M^1 的形态。上述三种情况的前齿带均很发育，成低的前边脊，与原尖前臂之间有沟隔开。原尖后臂均与前尖相连形成原脊 II。前尖高、大。内脊比较近中，稍成前外后内向。中脊发育，自中尖处直伸至牙齿外侧边缘，比较平直而横向，将外中谷分为两部。似有中附尖。次尖的形状和发育程度似原尖，成收缩的新月形，前臂与内脊融合。后尖的形状和大小似前尖，在两个齿列上的 M^1，后尖均与后边脊相连，而在其他单个牙齿中，有与后边脊相连的，也有与次尖中部相接的。关于后尖与后边脊或次尖后臂、次尖中部相连的情况见表 2。

原脊、中脊和后脊将牙齿外侧分成 4 个狭窄的沟谷。内中谷自谷口向前外伸，由于原

表 2 中亚副蹶鼠 M^1 的后尖与次尖及后边脊相接的情况

Table 2 Connection of metaloph in M1 in specimens of *Parasminthus asiae-centralis* from Ulantatal

地 点	UTL					总 计
	4a	4b	7a	7b	8b	
标本数	4	20	5	6	2	37
后尖连于后边脊或次尖后臂	25%	45%	80%	100%		54%
后尖与次尖中部相连	75%	55%	20%		100%	46%

尖后侧收缩，故谷的前壁很陡，后壁即次尖的前壁成缓坡。由于次尖后壁也收缩，在有些牙齿中，特别是那些后尖与后边脊相连的牙齿中，后壁在次尖后侧成凹陷。

除上述外，M^1 还有其他方面的变异，如后脊有自后尖中部伸出的，也有自后尖后侧伸出。又如，V10132.2 号标本中，原尖后臂与前尖相连的脊较低，但在此脊前原尖和前尖之间还有两条低脊相连，在原尖和前尖之间形成两个小的封闭坑。再如，V10135.3 号标本，前尖后侧与中脊的中部相连，此相连的脊与部分原脊、内脊和中脊一起围成一封闭的坑。

M^2 也大致呈长稍大于宽的长方形。前壁宽于后壁，虽有些牙齿后壁的宽度接近于前壁，但无一标本是后壁宽于前壁的。它与 M^1 不同还在于：一些标本具两条原脊，如 V10132.6 等，将原尖和前尖之间封闭成坑。这种情况和步林记述的甘肃标本一致。但另一些牙齿仅具原脊 I 而无原脊 II，如 V10136，由于前尖与原尖前臂相连，故原脊 I 自前尖伸向前内，与此相应，外中谷自谷口向前内伸得很远。当然，有些标本的原脊 II 很弱，如 V10132.7 等，它们似乎处于有无原脊 II 的过渡阶段。原脊 II 的发育程度在标本中所占的比例见表 3。然而，无论原脊 II 的情况怎样，后脊总是与次尖中部或前臂相连，绝没有与次尖后臂或后边脊相连的。在次尖后侧也没有象在 M^1 中具凹陷的情形。

M^3 与前两臼齿无论在形状上还是在结构上均有很大不同，而且变化较大。由于后壁

表 3 中亚副蹶鼠 M^2 的原脊 II 发育状况及在标本中所占的比例

Table 3 Developmental condition of protoloph II of M2 in specimens of *Parasminthus asiae-centralis* from Ulantatal

地 点	标本数	强，连前尖	弱，不连前尖	无，原尖后臂向外不超出内脊
UTL4a	3	67%	33%	
UTL4b	5	20%	40%	40%
UTL6	1	100%		
UTL7a	5	20%	20%	60%
UTL 7b	4	25%	25%	50%
UTL 8b	2	50%		50%
总计	20	35%	25%	40%

显著变窄，致使绝大部分牙齿成比较圆钝的等边三角形。有长宽近等的，如 V10133.30，但也有稍长的且后壁变窄不显的，如 V10133.28 等。原尖大，占据牙齿的前内角。前尖较瘦高，原脊比较横向而平直。内脊短，稍成前内后外向，自紧靠原尖处的原脊伸出，如 V10133.32 和 V10133.33 号标本等，但也有直接从原尖伸出的，如 V10133.36 等。由于在牙齿内侧边缘原尖和次尖间有脊相连，致使大部分标本的内谷封闭。但也有少数标本如 V10133.31，其内谷仍然开口。大部分标本都有短的内脊，但也有少数牙齿，如 V10132.9，无内脊，中脊直接出自原尖。个别标本，如 V10133.36，仅在中脊和后脊之间见有内脊。中脊一般都较发育，但也有个别标本，如 V10136.12，中脊细弱或不连续。牙齿的后半部分很收缩，次尖不如原尖显著，后尖没有前尖大。中脊、后脊和后边脊三者挨得很近。

表 4　乌兰塔塔尔的中亚副蹶鼠的下齿列测量(单位：毫米)

Table 4　Measurements of the lower tooth-row of *Parasminthus asiae-centralis* from Ulantatal (in mm)

地点	标本号	M_1-M_3	M_1-M_2	M_2-M_3	M_1		M_2		M_3	
					长	宽	长	宽	长	宽
UTL7b	V10136.1	4.80	3.50	3.10	1.75	1.20	1.60	1.20	1.35	1.10
UTL8b	V10137	5.35	3.75	3.50	1.85	1.25	1.90	1.40	1.65	1.40

M_1 为前缘稍窄的长方形，四个主尖在横向位置上下原尖比下后尖靠后，下次尖比下内尖靠后更为显著。下前边尖特别小而圆，突出在不太发育的前齿带上，比主要尖低得多。在下原尖和下后尖之间有一较深的凹陷，将两尖隔开，两尖之间仅在后侧相连，构成两端高、中部低的下后脊 II。下外脊与下原尖的后外侧相连，然后伸向后内。下中尖明显，下中脊一般都很发育，如 V10136.18 和 V10136.20 等，粗壮，自下中尖起直伸至牙齿内侧边缘，与下中附尖相接。还有些标本，如 V10133.49，除下中脊外，尚具短的外下中脊。唇侧谷在外侧宽阔，向内和向后迅速变窄。下内尖与下次尖前臂相连形成下次脊 I。下次尖后臂连于下后边脊。由于下次尖后侧收缩，故在牙齿的后外角显得凹。下次小尖只有在磨蚀后才显得清楚，位于下次尖后臂和下后边脊交接处。在多数标本中由于下后边脊与下内尖的后内侧相连，故将下后凹封闭成坑。

M_2 成矩形。有些标本下原尖前臂和下后尖分别与下前边脊相连，位置近牙齿前侧中部。另一些标本下原尖前臂和下后尖分别与连接下前边脊的纵脊相连。因此下后脊多少弯曲成 V 或 U 形。下原尖后臂和下中脊的发育情况可分为 5 类： 1. 下原尖后臂不发育，向内不超出下外脊，下中脊强；2. 下原尖后臂发育，向内超出下外脊，下中脊强； 3. 下原尖后臂与下后尖后侧相连形成下后脊 II，下中脊仍很强；4. 下原尖后臂与下中脊相汇； 5. 下中脊不发育，下原尖后臂形成假下中脊。关于这 5 种类型在牙齿中所占的比例见表 5。M_2 的其他特点同 M_1。下后边脊也与下内尖后内侧相连，封闭后内谷。

M_3 比 M_2 小，特别是后缘显著收缩变窄。与 M_2 不同还在于下中脊不发育(或与下原尖后臂融合)，下原尖后臂特别发育并形成假下中脊。由于下后边脊与下内尖和下后尖(可

表5 中亚副蹶鼠 M_2 的下原尖后臂与下中脊的发育情况

Table 5 Developmental condition of the posterior arm of protoconid and mesolophid of m_2 in specimens of *Parasminthus asiae-centralis* from Ulantatal

地点	标本数	下原尖后臂不超出下外脊,下中脊强	下原尖后臂超出下外脊,下中脊强	下原尖后臂与下后尖后侧相连成下后脊 II	下原尖后臂与下中脊汇合	下中脊弱,下原尖后臂形成假下中脊
UTL4a	5	21%	20%	40%		20%
UTL4b	13	23%	15%	31%	8%	23%
UTL7a	5	20%	20%	40%		20%
UTL7b	5	20%	20%	40%	20%	
UTL8b	2	50%		50%		
总计	30	23%	17%	36%	7%	17%

表6 乌兰塔塔尔的中亚副蹶鼠的单个牙齿测量(单位:毫米)

Table 6 Measurements of the isolated teeth of *Parasminthus* asiae-centralis from Ulantatal (in mm)

牙齿	长				宽				标本数
	平均数	变异范围	标准差	变异系数	平均数	变异范围	标准差	变异系数	
P^4	0.93	0.95—0.90	0.0274	0.03	0.93	0.95—0.90	0.0274	0.03	5
M^1	1.65	2.05—1.55	0.1301	0.08	1.43	1.80—1.25	0.1308	0.09	35
M^2	1.56	1.75—1.50	0.0803	0.05	1.36	1.55—1.25	0.0990	0.07	19
M^3	1.31	1.45—1.20	0.0722	0.06	1.28	1.40—1.15	0.0707	0.06	24
M_1	1.71	2.00—1.55	0.1530	0.09	1.20	1.40—1.10	0.0888	0.07	24
M_2	1.65	1.80—1.50	0.0855	0.05	1.21	1.40—1.10	0.0843	0.07	28
M_3	1.60	1.85—1.35	0.1488	0.09	1.25	1.45—1.00	0.1018	0.08	28

表7 乌兰塔塔尔的中亚副蹶鼠的 M^1 和 M^2 齿根情况

Table 7 Roots of M^1 and M^2 in specimens of *Parasminthus asiae-centralis* from Ulantatal

地点	标本数	3根	由3根向4根过渡	4根
UTL4a	5			100%
UTL4b	17	30%	35%	35%
UTL6	1			100%
UTL7a	7			100%
UTL7b	3	33%		67%
UTL8b	1			100%
总计	34	18%	18%	64%

能还有下中附尖)在内侧相连,致使下后尖与下后边脊之间牙齿内侧形成3个封闭的谷。

上、下颌骨上7个牙齿的齿根情况是: P^4 为单齿根, M^3 是3齿根,下臼齿均为两齿根, M^1 和 M^2 的唇侧是两齿根,而舌面根比较复杂,有的只具一单一的根,有的这单根中间有凹陷,有的该根在唇侧相连而在舌侧明显分开,有的内侧完全具两根。我们将前一

种情况叫做具 3 根，将中间两种情况叫做由 3 根向 4 根过渡，将后一种称为具 4 根。

比较与讨论　上述牙齿，在大小和基本结构上与中亚副蹶鼠的一致，但形态明显地比甘肃党河发现的复杂。如 M^1 在甘肃标本中，后尖与后边脊或次尖后臂相连，而在乌兰塔塔尔标本中，不仅此种情况存在，而且还有后尖与次尖中部相连者。又如，M^2 在党河标本中具两条原脊，而在乌兰塔塔尔材料中，具两条原脊的牙齿有之，具一条者也有之。再如，M_2 在党河标本中（T. b. 569a），步林认为下中脊在近端与下原尖后臂融合，但实际上应该是由下原尖后臂发育成的假下中脊，而在乌兰塔塔尔，下原尖后臂与下中脊的发育情况就比较多样。还有，甘肃的 M^1 和 M^2 均具 4 根，而在乌兰塔塔尔标本中，少数还具 3 根或呈 3 根向 4 根过渡状态。

上述情况，作者曾试图将它们按不同的特点区分开来，但结果表明还是把它们放在一个种中比较合适。原因是：1. 无论是 M^1 的后脊的连接情况、M^2 原脊的数目和发育状况、M_2 下原尖后臂和下中脊的发育情况，还是前两上臼齿的齿根数目，都表现了一定的过渡性。2. 甘肃发现的标本无论是大小还是形态都落在乌兰塔塔尔牙齿的变异之中。3. 两个牙齿在一些特点上一致，在另一些特点上又不同。如 V10133 号标本上的 M^1 与 V10132.5 号标本，它们的原尖前臂均短，呈游离状态，性质完全一致，但前者的后尖与后边脊连，而后者的后尖则与次尖中部相接。4. 同一齿列上的牙齿具不同的性质。如甘肃党河发现的 M^1 后尖与后边脊相连，而 M^2 具两条原脊（见正型标本）。在乌兰塔塔尔发现的 V10136 号标本中，M^1 的后尖与后边脊相连，与正型标本一致，但 M^2 只具一条原脊（见图 1），又不同于甘肃材料。如果我们按每一个特征来区分乌兰塔塔尔的标本，就会千奇百怪，出现许多属种。实际上好多特征都是过渡的，所以将乌兰塔塔尔的材料归到中亚副蹶鼠种中是合适的。

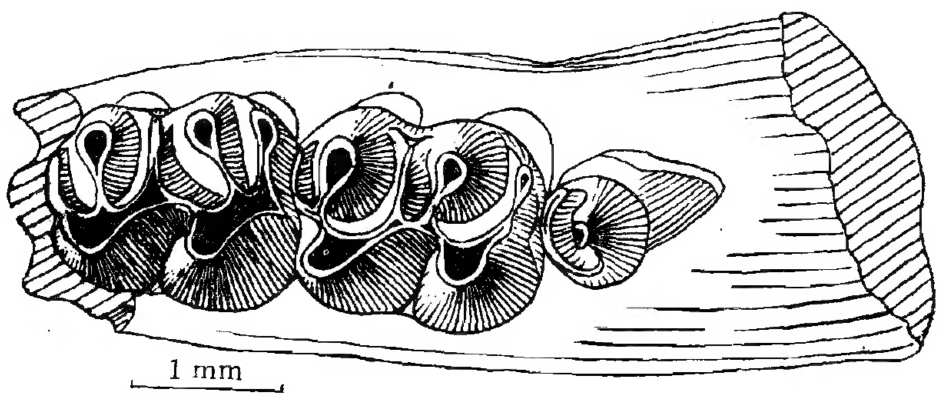

图 1　中亚副蹶鼠的上齿列（V10136）

Fig. 1. The upper dentition of *Parasminthus asiae-centralis* (V10136)

党河副蹶鼠 *Parasminthus tangingoli* Bohlin, 1946

（图版 III，1—15）

材料　UTL3：单个的 $M^1$4 个（V10151.1—4）；$M^2$7 个（V10151.5—11）；$M^3$3 个

表 8 党河副蹶鼠的上齿列测量(单位：毫米)

Table 8 Measurements of the upper tooth-row of *Parasminthus tangingoli* (in mm)

地点	标本号	P^4-M^2	P^4-M^1	M^1-M^2	M^2-M^3	P^4		M^1		M^2		M^3	
						长	宽	长	宽	长	宽	长	宽
UTL4a	V10152	2.65	1.65	2.30		0.50	0.50	1.15	1.00	1.10	1.05		
	V10152.1			2.60				1.35	1.15	1.20	1.10		
	2		1.65			0.50	0.55	1.15	1.10				
	3			2.25				1.15	0.95	1.10	0.90		
	4			2.15				1.15	0.95	1.05	0.90		
UTL4b	V10153		1.85			0.70	0.65	1.10	1.05				
	V10153.1				2.45					1.45	1.30	1.00	1.00
	2				1.90					1.10	1.00	0.80	0.80
	3				1.90					1.05	0.95	0.85	0.85
UTL7b	V10156			2.30				1.15	1.10	1.15	1.05		
	V10156.1			2.25				1.15	1.10	1.10	1.00		
UTL8b	V10157	2.30	1.85	2.75		0.65	0.65	1.40	1.35	1.35	1.20		
	V10157.1		1.75			0.50	0.50	1.20	1.15				
	2				1.95					1.10	0.90	0.90	0.90
	T. b. 593a	3.10	1.80	2.50		0.50	0.60	1.30	1.20	1.30	1.20		

注：T.b. 593a 是发现在甘肃党河副蹶鼠的正型标本，由步林测量。

(V10151.12—14); $M_1$13 个 (V10151.15—27); $M_2$4 个 (V10151.28—31)。UTL4a：右上齿列附颊齿 P^4-M^2 (V10152);上齿列 4 个 (V10152.1—4);下齿列 3 个 (V10152.5—7);单个的 $P^4$6 个 (V10152.8—13); M^1 69 个(V10152.14—82); $M^2$43 个(V10152.83—125);$M^3$3 个(V10152.126—128), $M_1$37 个(V10152.129—165); $M_2$36 个 (V10152.166—201); $M_3$9 个 (V10152.202—210)。UTL4b:右上齿列附颊齿 P^4-M^1 (V10153); 上齿列 3 个 (V10153.1—3); 下齿列 4 个 (V10153.4—7); 单个的 $P^4$12 个 (V10153.8—19); $M^1$137 个 (V10153.20—156); $M^2$82 个 (V10153.157—238); $M^3$13 个 (V10153.239—251); M_1 142 个 (V10153.252—393); M_2 110 个 (V10153.394—503); M_3 25 个 (V 10153.504—528)。UTL6:单个的 $P^4$1 个 (V10154.1); $M^1$3 个 (V10154.2—4); $M^3$2 个 (V10154.5—6); M_1 14 个 (V10154.7—20); M_2 5 个 (V10154.21—25); M_3 2 个 (V 10154.26—27)。UTL7a: 下齿列 1 个 (V10155);单个的 $P^4$1 个 (V10155.1); $M^1$16 个 (V10155.2—17); $M^2$10 个 (V10155.18—27); $M_1$20 个 (V10155.28—47); $M_2$13 个 (V 10155.48—60)。UTL7b:右上齿列附 M^1-M^2 (V10156);上齿列 1 个 (V10156.1); 下齿列 3 个 (V10156.2—4); 单个的 $M^1$10 个 (V10156.5—14); $M^2$5 个 (V10156.15—19); $M^3$8 个 (V10156.20—27); $M_1$12 个 (V10156.28—39); $M_2$7 个 (V10156.40—46); $M_3$7 个 (V10156.47—53)。UTL8b:左上齿列附 P^4-M^2 (V10157);上齿列 2 个 (V10157.1—2);下齿列 5 个 (V10157.3—7); 单个的 $M^1$6 个 (V10157.8—13);$M^2$6 个(V10157.14—19); $M_1$3 个 (V10157.20—22); $M_2$3 个 (V10157.23—25); $M_3$2 个 (V10157.26—27)。

增订特征　个体中等大小的一种副蹶鼠（前面的两个臼齿长在 1—1.5 毫米之间)。M^1 的后尖在大部分标本中与次尖中部相接，与次尖后臂或后边脊相连者很少。M^2 具两条原脊的标本只约占 10%。上述两臼齿具 4 根者仅占 20%。

记述　P^4 的结构相似于中亚副蹶鼠的 P^4，只是尺寸小些。

M^1 有些标本近方形，有些长大于宽成长方形。前、后壁一般宽度近等或后壁稍宽于前壁，但也有少数标本前壁略宽于后壁。大多数牙齿的原尖前臂形成牙齿前壁，前齿带无或极弱。少数标本如 V10153.23 等，前臂直伸向牙齿前外角，与前齿带发育形成的低的前边脊之间以浅沟相隔。个别牙齿如 V10153.33 等，原尖前臂短而成游离状。还有极个别标本如 V10153.48 和 V10155.2，它们的原尖前臂与前尖前侧相连形成原脊 I。原尖前臂的上述情况与亚洲副蹶鼠的相似。原尖后臂无一例外地与前尖相连形成原脊 II。中尖不大，但很明显，中脊横向，平直地伸至牙齿外侧边缘，多数标本具中附尖。绝大多数牙齿的后尖均与次尖中部相连，但也有少数标本连于次尖后臂或后边脊。

M^2 的形状与中亚副蹶鼠的基本一致，有成长方形的，如 V10153.159 等；也有较方的，如 V10153.161 等，但无论是那种情况，前壁都不同程度地宽于后壁。与 M^1 不同还在于：牙齿的前齿带发育形成前边脊，原尖前臂的前支在其内三分之一处与之相连，原尖前臂的后支与前尖相连形成原脊 I，大部分牙齿不具原脊 II（见表 9)。后尖与次尖前臂或中部相连，无一标本与后臂或后边脊相接。

M^3 成方圆形，长宽大致相等。原尖很收缩，但仍很大，前臂与前边脊融合，原脊比较靠前，应属原脊 I。前尖是除原尖外牙齿中最大的尖。内脊短，自接近原尖处的原脊后侧伸出。中尖小，但清楚。中脊直伸至外侧边缘，在一些标本中有中附尖。次尖小，后尖

表 9　党河副蹶鼠 M^2 具原脊 II 的牙齿在标本中所占的比例

Table 9　Developmental condition of Protoloph II of M^2 in specimens of *Parasminthus tangingoli* from Ulantatal

地　点	标本数	具原脊 II.	原脊 II 弱,即原尖后臂向外超出内脊	无原脊 II.即原尖后臂向外不超出内脊
UTL3	7	29%	29%	42%
UTL4a	47	11%	30%	59%
UTL4b	74	7%	25%	68%
UTL7a	10	10%	20%	70%
UTL7b	7		29%	71%
UTL8b	8	38%	13%	49%
总计	153	10%	26%	64%

表 10　党河副蹶鼠的下齿列测量(单位：毫米)

Table 10　Measurements of the lower tooth-row of *Parasminthus tangingoli* from Ulantatal (in mm)

地点	标本号	M_1-M_3	M_1-M_2	M_2-M_3	M_1		M_2		M_3	
					长	宽	长	宽	长	宽
UTL4a	V10152.5		2.90		1.45	1.00	1.45	1.05		
	6			2.55			1.30	0.95	1.15	0.85
	7			2.20			1.20	0.90	1.00	0.75
UTL4b	V10153.4			2.55			1.40	1.00	1.25	0.95
	5		2.30		1.15	0.80	1.25	0.85		
	6	3.10	2.20	2.00	1.10	0.75	1.15	0.80	0.90	0.70
	7			2.00			1.15	0.80	0.90	0.75
UTL7a	V10155	3.25	2.35	2.10	1.20	0.80	1.10	0.80	0.95	0.75
UTL7b	V10156.2		2.55		1.25	0.95	1.25	0.95		
	3	3.20	2.30	2.00	1.20	0.85	1.10	0.85	0.95	0.75
	4	3.25	2.35	2.10	1.15	0.80	1.15	0.85	0.90	0.65
UTL8b	V10157.3	3.85	2.70	2.60	1.40	1.00	1.40	1.00	1.20	1.00
	4		2.55		1.30	0.95	1.35	1.05		
	5		2.35		1.20	0.95	1.25	0.90		
	6			2.15			1.20	0.85	1.00	0.75
	7			2.20			1.30	0.90	0.90	0.70

成脊状融合在后脊中。后脊与次尖前臂相连。在一定的磨蚀后，有些牙齿内中谷封闭成坑。

下颌骨咬肌窝较深，咬肌脊发育，前缘达 M_1 前侧。颏孔紧靠 M_1 的前方，位置相当靠上。上升支自 M_2 后缘升起。

M_1 长大于宽，后壁宽于前壁。下前边尖小而圆，位于下前边脊中部，比四个主尖低得多。下原尖和下后尖在横向上基本对齐，比下次尖和下内尖相互靠得较近。下次尖在横向上比下内尖靠后。下原尖和下后尖仅在基部相连形成极短的下后脊 II。下外脊自下原尖后侧起向后内伸至下中尖，下中尖之后的下外脊比较纵向。下中尖较大，在有些标本中

表 11　党河副蹶鼠 M_2 的下原尖后臂与下中脊的发育情况

Table 11　Developmental condition of the posterior arm of protoconid and the mesolophid of M_2 in specimens of *Parasminthus tangingoli* from Ulantatal

地　点	标本数	下原尖后臂不超出下外脊，下中脊强	下原尖后臂超出下外脊，下中脊强	下原尖后臂与下后尖后侧相连成下后脊 II	下原尖后臂与下中脊汇合	下中脊弱，下原尖后臂成假下中脊
UTL3	4	25%		75%		
UTL4a	39	15%	10%	36%	24%	15%
UTL4b	113	27%	10%	29%	11%	24%
UTL6	5	20%	20%			60%
UTL7a	14	36%	7%	21%	21%	15%
UTL7b	10	30%	10%	30%	10%	20%
UTL8b	8	13%	25%	37%	25%	
总计	193	25%	10%	30%	14%	21%

表 12　乌兰塔塔尔的党河副蹶鼠的单个牙齿测量(单位：毫米)

Table 12　Measurements of the isolated teeth of *Parasminthus tangingoli* from Ulantatal (in mm)

牙齿	长				宽				标本数
	平均数	变异范围	标准差	变异系数	平均数	变异范围	标准差	变异范围	
P^4	0.71	0.80—0.60	0.0455	0.06	0.70	0.80—0.60	0.0394	0.06	20
M^1	1.21	1.45—1.10	0.0937	0.08	1.05	1.35—0.85	0.1098	0.10	245
M^2	1.20	1.45—1.05	0.0995	0.08	1.09	1.35—0.85	0.0942	0.09	143
M^3	0.95	1.05—0.85	0.0673	0.07	0.95	1.05—0.85	0.0719	0.08	29
M_1	1.27	1.45—1.10	0.0998	0.08	0.90	1.10—0.70	0.0852	0.10	241
M_2	1.25	1.45—1.10	0.1034	0.08	0.91	1.10—0.75	0.0809	0.09	178
M_3	1.16	1.35—1.00	0.1078	0.09	0.91	1.10—0.75	0.0807	0.09	44

比较靠前，这样下中脊就比较靠近下后脊 II。在多数标本中，下中脊横向，但也有些牙齿稍成前内后外向。下中脊直伸至牙齿内侧边缘，下中附尖在有些标本中明显，在有些牙齿中不显。外下中脊不发育。由于下内尖比下次尖明显靠前，因此自下内尖伸出的下次脊不与下次尖相连，而直接连于下次尖之前的下外脊。下次尖后臂与下后边脊融合成粗壮的脊，并与下内尖后侧相连，封闭下后凹。

M_2 呈长大于宽的长方形，前壁和后壁宽度近等，内侧和外侧长度大致相当或外侧稍长于内侧。下原尖略比下后尖靠后，两尖之间均有沟与下前边脊隔开。下后尖与下原尖前臂均与一连接下前边脊的纵脊相连，该纵脊与下前边脊的中部相连。因此，下后脊 I 并不平直，在有些标本中明显向前凸。下原尖后臂和下中脊的发育情况也大致可分为 5 类(表 11)。牙齿的后半部分结构相似于 M_1。

M_3 前壁较宽，后壁变尖，外侧比内侧略短。与 M_2 不同还在于：下原尖后臂很发育，直伸至牙齿内侧边缘，形成假下中脊。无下中尖和真正的下中脊。下外脊自下原尖后臂起，向后内伸的程度在各标本中稍有差异。下内尖很小，与下次尖前臂相连形成下次脊 I。稍经磨蚀，假下中脊与下次脊前后的谷先后封闭。

表 13 乌兰塔塔尔的党河副蹶鼠的 M^1 和 M^2 的齿根情况
Table 13 Roots of M^1 and M^2 in specimens of *Parasminthus tangingoli* from Ulantatal

地 点	标本数	3 根	由 3 根向 4 根过渡	4 根
UTL3	9	56%	33%	11%
UTL4a	88	40%	40%	20%
UTL4b	160	29%	52%	19%
UTL7a	23	30%	61%	9%
UTL7b	14	36%	50%	14%
UTL8b	6	83%	17%	
总计	300	35%	48%	17%

牙齿齿根情况与中亚副蹶鼠的相同，M^1 和 M^2 有具 4 根的，也有只具 3 根。3 根、4根以及从 3 根向 4 根过渡的牙齿在标本中所占的比例见表 13。

比较和讨论 由上面描述可知，在乌兰塔塔尔地区发现的党河副蹶鼠的颊齿形态要比在甘肃发现的复杂得多，这种情况和在中亚副蹶鼠种中相同，但程度不一样，步林在建副蹶鼠中亚种和党河种时，认为两者形态比较接近，区别主要在大小。新发现的材料表明，它们之间的不同，不仅仅是个体大小，而且表现在颊齿结构的变化上。中亚种的 M^1 后脊与次尖后臂或后边脊相连的、和与次尖中部相接的标本几乎各半；而党河种中与次尖后臂或后边脊相连的极少，绝大部分标本与次尖中部相连。前者 M^2 具两条原脊的约占三分之一，而后者仅有百分之十，绝大部分标本原尖后臂短而不与前尖相连。前者 M^1 和 M^2 的齿根有三分之二以上的牙齿具 4 根，而后者具 4 根的标本仅有不足百分之二十，百分之八十以上的牙齿均为 3 根或由 3 根向 4 根过渡。上述情况表明：M^1 的后脊与次尖后臂或后边脊相连、M^2 具两条原脊及这两牙齿具 4 根的在标本中所占的比例，中亚种均比党河种高得多。

小副蹶鼠 *Parasminthus parvulus* Bohlin, 1946

（图版 IV,1—13）

材料 UTL3：单个的 $P^4$2 个（V10158.1—2）；$M^1$8 件(V10158.3—10)；$M^2$2 个（V 10108.11—12)；$M^3$1 个(V10158.13)；$M_1$6 件(V10158.14—19)；$M_2$7 个（V10158.20—26)；$M_3$5 件（V10158.27—31)。UTL4a：一残破的左上颌骨附 P^4-M^1(V10159)；上齿列 4 个(V10159.1—4)；下齿列 4 件(V10159.5—8)；单个的 $P^4$3 件（V10159.9—11)；$M^1$60 个(V10159.12—71)；M^2 31 件（V10159.72—102)；M^3 1 个（V10159.103)；M_1 53 件(V 10159.104—156)；$M_2$48 个（V10159.157—204)。UTL4b：一右上颌残段附 M^1-M^3(V 10160)；上齿列 7 件（V10160.1—7)；下齿列 6 个（V10160.8—13)；单个的 $P^4$12 件(V 10160.14—25)；$M^1$203 个(V10160.26—228)；$M^2$153 件（V10160.229—381)；$M^3$23 个(V 10160.382—404)；$M_1$189 件(V10160.405—593)；$M_2$174 个（V10160.594—767)；$M_3$54 个(V10160.768—821)。UTL6：单个的 $P^4$3 件（V10161.1—3)；$M^1$62 个(V10161.4—65)；$M^2$72 件(V10161.66—137)；$M^3$5个(V10161.138—142)；$M_1$65件(V10161.143—207)；$M_2$64

个(V10161.208—271)；$M_3$27 个(V10161.272—298)。UTL7a：残破的右上颌骨附 M^1-M^3 (V10162)；上齿列 1 个 (V10162.1)；下齿列 3 个 (V10162.2—4)；单个的 $P^4$1 件 (V10162.5)；$M^1$22 个(V10162.6—27)；$M^2$23 件 (V10162.28—50)；$M_1$36 个 (V10162.51—86)；$M_2$26 件(V10162.87—112)。UTL7b：一右上颌骨残段附 P^4-M^1(V10163)；上齿列 2 件(V10163.1—2)；下齿列 4 件(V10163.3—6)；单个的 $P^4$2 件 (V10163.7—8)；$M^1$24 个 (V10163.9—32)；$M^2$20 件(V10163.33—52)；$M^3$1 个(V10163.53)；$M_1$20 件 (V10163.54—73)；$M_2$11 个(V10163.74—84)；$M_3$2 个(V10163.85—86)。UTL8b：一残破的左下颌骨附 M_1-M_3(V10164)；下牙床 1 个 (V10164.1)；单个的 $M^1$2 件 (V10164.2—3)；$M^2$8 个(V10164.4—11)；$M_1$2 件(V10164.12—13)；$M_2$1 个(V10164.14)。

增订特征　一种小型的副蹶鼠(前面两个臼齿的长度一般都小于 1 毫米)。M^1 的原尖前臂伸至前外角，构成牙齿前壁；后尖基本上都与次尖中部相连。M^2 一般无原脊 II。

记述　P^4 与多数林跳鼠的相似，小，齿冠圆形，比齿根(单根)略宽大，冠面由一主尖(位于牙齿的前外部)和后边脊组成。在有些牙齿中，如 V 101603 号标本，后边脊在前外角突起，因此在主尖的后外侧似有一尖。但无标本象步林所说的小副蹶鼠那样 P^4 具次尖。主尖的大小变化较大，如 V10159.5 的 P^4 的主尖比在其他标本上相对大得多，但后边脊又相对比其他 P^4 的微弱。P^4 的大小很不稳定，如 V10160.5 齿列上的 M^1 比 V10160.6 齿列上的 M^1 大，但 P^4 反而比 V10160.6 齿列上的 P^4 小。因此，这个种 P^4 的结构变化不大，但大小很不稳定。

M^1 大致成长方形或方形。前壁宽于、等于或窄于后壁。前齿带有的粗壮，有的较细，但位置均较低，在齿列上一般与 P^4 的冠面持平。原尖前臂直伸至牙齿前外角，构成牙齿前壁。原尖后臂向后外伸，与前尖连成原脊 II。中尖中等大小，中脊在绝大部分标本中均很发育，粗壮，横向。中附尖由弱到明显。后尖一般都与次尖中部相连，但也有少数标本后尖与次尖连接的位置稍靠前或靠后的。还有极个别的牙齿后脊偏后与次尖后臂连，如在 UTL4b 中仅有两块，占总数(203)不到百分之一，而且这两个牙齿个体在小副蹶鼠中偏大，它们有可能属于党河种，如果是这样，那么小副蹶鼠种中 M^1 后尖就清一色地不与次尖后臂或后边脊相连。这两块标本暂归在此种，是因为它们的大小仍在小副蹶鼠的变异范围中。次尖后臂与后边脊融合。

M^2 略呈长方形，前壁稍宽于后壁。原尖前臂向前外伸，在多数标本中与前边脊中部相连。原脊与原尖连接的位置比较靠前，为原脊 I。除极个别标本(占总数不到百分之一)具短而弱的原脊 II 外，牙齿基本上只有一条原脊。后尖连于次尖前臂。牙齿的其他特点相似于 M^1。

M^3 形状不规则，多为方圆形。内侧收缩，后壁变窄。原尖大，横向压缩。原尖前臂与前边脊融合。原脊与原尖连接的位置相当靠前。在有些标本中，缺失内脊前段，即在原脊和中尖之间无脊相连。在有些牙齿中，这部分的内脊短而弱，自接近原尖处的原脊后侧伸出。中尖小。中脊明显，在有些标本中与后脊平行；在另一些标本中成前外后内向。在后一种情况下，中尖靠后，成为中脊、内脊和后脊的交汇处。后尖不如前尖发育，次尖远比原尖小。后尖与次尖前臂相连形成后脊 I。次尖后臂与后边脊融合。外侧齿带发育在边缘形成脊状齿带，封闭外侧谷。许多标本由于原尖和次尖在内侧边缘相连，因而内中谷常常

表 14 小副蹶鼠的上齿列测量(单位：毫米)

Table 14 Measurements of the upper tooth-row of *Parasminthus parvulus* from Ulantatal (in mm)

地点	标本号	P^4-M^2	P^4-M^1	M^1-M^3	M^1-M^2	M^2-M^3	P^4		M^1		M^2		M^3	
							长	宽	长	宽	长	宽	长	宽
UTL4a	V10159		1.05				0.35	0.35	0.80	0.70				
	.1		1.25				0.40	0.45	0.90	0.80				
	.2				1.80				0.95	0.85	0.90	0.80		
	.3				1.90				1.00	0.85	0.95	0.80		
	.4					1.45					0.85	0.75	0.65	0.65
UTL4b	V10160			2.65	2.00	1.50			1.05	0.90	0.95	0.90	0.65	0.75
	.1			2.35	1.70	1.35			0.90	0.75	0.85	0.75	0.60	0.65
	.2			2.40	1.80	1.45			0.95	0.80	0.90	0.80	0.55	0.60
	.3		1.40				0.45	0.50	0.95	0.75				
	.4		1.25				0.35	0.40	0.90	0.75				
	.5		1.15				0.30	0.35	0.85	0.75				
	.6		1.15				0.35	0.45	0.80	0.70				
	.7					1.45					0.90	0.80	0.55	0.65
UTL7a	V10162								0.90	0.70	0.85	0.70	0.50	0.50
	.1	1.95	1.25				0.35	0.35	0.85	0.75	0.85	0.75		
UTL7b	V10163		1.30				0.35	0.35	1.00	0.85				
	.1		1.15				0.35	0.35	0.85	0.75				
	.2		1.50				0.45	0.45	1.05	0.90				
	T.b.592a					1.70	0.40	0.50			1.10	1.00	0.75	0.75

注：T.b.592a 是小副蹶鼠的正型标本，由步林(1946)测量

表 15　乌兰塔塔尔的小副蹶鼠的单个牙齿测量(单位：毫米)

Table 15　Measurements of the isolated teeth of *Parasminthus parvulus* from Ulantatal (in mm)

牙齿	长				宽				标本数
	平均数	变异范围	标准差	变异系数	平均数	变异范围	标准差	变异系数	
P^4	0.49	0.60—0.30	0.0825	0.17	0.48	0.60—0.35	0.0668	0.14	23
M^1	0.93	1.05—0.75	0.0881	0.09	0.81	0.95—0.65	0.0818	0.10	381
M^2	0.87	1.00—0.70	0.0865	0.10	0.78	0.95—0.65	0.0673	0.09	309
M^3	0.67	0.80 -0.55	0.0911	0.14	0.69	0.80 -0.60	0.0715	0.10	31
M_1	0.94	1.05—0.75	0.0990	0.11	0.68	0.85—0.60	0.0576	0.08	371
M_2	0.94	1.05—0.75	0.0693	0.07	0.70	0.85—0.60	0.0548	0.08	331
M_3	0.77	0.90—0.65	0.0578	0.08	0.63	0.85—0.50	0.0620	0.10	88

表 16　小副蹶鼠的下齿列测量(单位：毫米)

Table 16　Measurements of the lower tooth-row of *Parasminthus parvulus* from Ulantatal (in mm)

地　点	标本号	M_1-M_3	M_1-M_2	M_2-M_3	M_1		M_2		M_3	
					长	宽	长	宽	长	宽
UTL4a	V10159.5		2.10		1.05	0.75	1.05	0.80		
	.6		1.75		0.90	0.65	0.85	0.70		
	.7		1.50		0.80	0.55	0.80	0.60		
	.8			1.40			0.80	0.65	0.65	0.60
UTL4b	V10160.8		2.05		1.00	0.75	1.05	0.80		
	.9		1.75		0.90	0.70	0.90	0.75		
	.10	2.60	1.80	1.70	1.00	0.60	1.00	0.65	0.75	0.55
	.11	2.35	1.65	1.55	0.80	0.60	0.85	0.65	0.70	0.55
	.12			1.70			1.00	0.75	0.75	0.65
	.13			1.55			0.95	0.75	0.65	0.60
UTL7a	V10162.2		2.10		1.05	0.75	1.08	0.80		
	.3			1.60			0.90	0.70	0.75	0.65
	.4			1.60			0.90	0.70	0.75	0.60
UTL7b	V10163.3	2.55	1.85	1.65	0.95	0.65	0.95	0.70	0.75	0.60
	.4		2.00		1.00	0.75	1.00	0.80		
	.5	2.75	2.00	1.75	1.00	0.70	1.00	0.70	0.75	0.65
	.6		1.75		0.85	0.65	0.90	0.70		
UTL8b	V10164	3.00	2.10	1.90	1.05	0.75	1.05	0.75	0.85	0.65
	.1			1.80			1.00	0.75	0.85	0.70

封闭。

下颌骨均残缺不全，从有些标本保存的部分看，咬肌窝前缘达 M_1 的后缘。颏孔位于 M_1 的前下方，接近骨体背侧。下门齿横切面近前后稍长之椭圆形，釉质层分布约占齿壁的三分之一。

M_1 后壁宽于前壁，前缘微凸。下前边尖小而圆，位于前缘中部，比主要尖低得多，也

表 17 小副蹶鼠 M_2 的下原尖后臂与下中脊的发育情况

Table 17 Developmental condition of the posterior arm of protoconid and the mesolophid of m_2 in specimens of *Parasminthus parvulus* from Ulantatal

地 点	标本数	下原尖后臂不超出下外脊，下中脊强	下原尖后臂超出下外脊，下中脊强	下原尖后臂与下后尖后侧相连成下后脊 II	下原尖后臂与下中脊汇合	下中脊弱，下原尖后臂形成假下中脊
UTL3	7	43%		14%	14%	29%
UTL4a	45	22%	11%	11%	11%	45%
UTL4b	166	25%	8%	14%	17%	36%
UTL6	62	37%	8%	5%	11%	39%
UTL7a	24	17%	12%	21%	17%	33%
UTL7b	11	36%	9%	9%	18%	28%
总计	315	27%	9%	12%	15%	37%

表 18 小副蹶鼠的 M^1 和 M^2 的齿根情况

Table 18 Roots of M^1 and M^2 in specimens of *Parasminthus parvulus* from Ulantatal

地 点	标本数	3 根	3 根向 4 根过渡	4 根
UTL3	10	80%	10%	10%
UTL4a	87	52%	28%	20%
UTL4b	275	48%	30%	22%
UTL6	114	1%	5%	94%
UTL7a	40	40%	30%	30%
UTL7b	37	30%	38%	32%
UTL8b	10	40%	60%	
总计	573	38%	25%	37%

不如下后脊和下次脊高，大致相当于下中脊的高度。下原尖和下后尖在边缘以齿带式与下前边脊相连，两尖等大近高，在横向上比较对齐。下原尖与下后尖后侧相连形成微向后凸、中部略低的下后脊 II。下外脊自下后脊 II 外三分之一处向后稍偏内伸出。下中尖一般较大。下中脊发育，横向，在大多数牙齿中自下中尖伸至内侧边缘粗壮程度不减。下中附尖在多数标本中明显。下次尖比下内尖显著靠后，一般下次尖前缘正好与下内尖后缘对齐。下次脊与下次尖前臂相连。下次尖后臂与下后边脊融合。

M_2 成长大于宽的矩形。下原尖前臂与下后尖均与下前边脊中部之下前边尖相接，或相连后形成短的纵脊再与下前边尖相接。在下原尖和下后尖之前均有沟与下前边脊隔开。下原尖后臂一般很发育，有些直伸至内侧边缘形成假下中脊，有些与下中脊融合形成统一的下中脊。还有一些牙齿，下原尖后臂不超出下外脊。少量标本具下后脊 II。M_2 这方面的特点与两个大种的情形一致，只是比例不同而已(表 17)。牙齿后半部分形态相似于 M_1。

M_3 结构基本上与 M_2 相似，但牙齿前宽后窄明显，尖脊变异较大，如下原尖后臂在有些标本中很发育，直伸至牙齿内侧边缘，有些标本则很短，还有些标本似与下后尖后侧相接。下中尖不很明显，无真正的下中脊。下次脊在有些标本中连于下次尖前臂，有些标本

连于下次尖之前的下外脊上。下次尖前侧收缩显著，故下外中谷向内向后伸得很远，显得不对称。下次尖后臂与下后边脊融合，并与下内尖后内侧相接，封闭后内谷。

齿根情况相似于副蹶鼠属中的两个大种，但 M^1 和 M^2 具 4 根在标本中所占的比例介于亚洲副蹶鼠和党河副蹶鼠之间。

比较　小副蹶鼠与副蹶鼠属中两个大种的差别不仅表现在个体大小上，而且从牙齿的形态特征上也易把它们区分开来。在中亚种，M^1 后尖与后边脊或次尖后臂相连的牙齿占总数之半，在党河种也有很少一部分标本保留了这种状况，而在小副蹶鼠中则基本上都是与次尖中部相连的。M^2 的原脊，在中亚种具两条的占三分之一，在党河种占百分之十，而在小副蹶鼠基本上都是清一色的只具原脊 I。此外，M_2 除下后脊 I 外，由下原尖后臂发育成的下后脊 II 在两个大种约占三分之一，而在小副蹶鼠只占百分之十。因此，从牙齿角度看，小副蹶鼠是副蹶鼠属中的一个很特征的种。

戈壁蹶鼠属(新属) *Gobiosminthus* gen. nov.

属的特征　上臼齿脊形化程度强，沟谷深窄。M^1 和 M^2 的后尖(或后脊)与后边脊相连。M^2 的原脊与原尖后臂相连而不与前臂相接，形成原脊 II，位置相当靠后，相似于 M^1。

属型种　邱氏戈壁蹶鼠(新种) (*Gobiosminthus qiui* sp. nov.)。

包括种？戈壁蹶鼠未定种 (?*Gobiosminthus* sp.)。

邱氏戈壁蹶鼠(新种) *Gobiosminthus qiui* sp. nov.

(图版 II,4; 图2)

正型标本　一残破的右上颌骨附颊齿 M^1-M^3(V10167, UTL7a)。

归入材料　UTL4a：单个的 M^1 两个 (V10165.1—2); UTL4b：单个的 $M^1$5 个 (V10166.1—5); $M^2$1 个(V10166.6)。UTL7a：M^1 一个(V10167.1)。

地点和层位　内蒙古阿左旗乌兰塔塔尔，中渐新世乌兰塔塔尔组。

种的特征　同属的特征。

词义　属名表示化石发现在内蒙古戈壁滩上，种名赠给与作者多次讨论林跳鼠科化石的邱铸鼎先生。

描述　从正型标本看，M^1 长稍大于宽，近于方形，内壁和后壁分别比外壁和前壁略短。前齿带低，细弱，在原尖前侧比较明显。原尖比较浑圆，顶部略收缩，基部较膨大。原尖前臂很粗壮，伸向前外方，可能与前边脊汇合形成牙齿前壁。原尖后臂较细短，向后外方伸，与斜向后内方的前尖相接形成原脊 II，相接处也正好是内脊的起始处。前尖略成棒锤状。内脊近中。中脊横向，粗壮，直伸至牙齿的外侧边缘。次尖似原尖，但后部收缩不如原尖显著，尽管如此，牙齿后壁在次尖收缩处仍形成一凹。次尖前臂很粗壮，直伸向中尖。次尖后臂较细，向后外伸至后边脊。后尖与前尖同，形似棒锤，与后边脊相连。牙齿外侧具 4 个谷，而内侧仅有一内中谷。由于尖、脊比较发育，粗壮，致使这些沟谷显得非常深窄。内中谷向外向前伸，强烈不对称。由于原尖后壁收缩，故此谷前侧异常陡峻，后侧成缓坡。

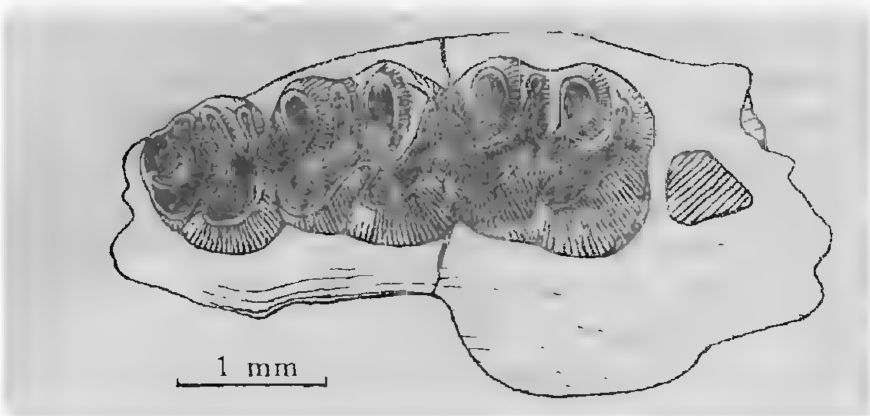

图 2 邱氏戈壁蹶鼠的上颊齿 (V10167)

Fig. 2. The upper cheek teeth of *Gobiosminthus qiui* gen. et sp. nov. (V10167)

M^2 基本特点相似于 M^1,但形状接近矩形,长大于宽,后壁较 M^1 更窄于前壁。原尖前的齿带无或更微弱。它象 M^1 一样,前尖与原尖后臂或内脊相连,仅有原脊 II 而无原脊 I,其位置与内中谷谷顶正好相对。由于中脊比较直,因而中脊前、后的外侧谷比较横向。

M^3 的形状和结构与前两臼齿有很大的不同,成较圆的等边三角形,大致可分前、后内和后外三个面。前边脊发育,原尖和前尖大而清楚,两尖相连成粗壮的原脊,中部微向前凸。前尖与前边脊间的沟明显。中脊前的沟与内中谷相通。由于内中谷特别狭窄,故次尖与原尖靠得很近。次尖与中脊相连,形成相似于原脊的弧形脊,该脊与后尖之间有半圆形的沟凹。后尖为一锥形尖,紧靠牙齿的后外角。次尖后臂与后边脊相连。经一定磨蚀后,各沟谷在牙齿边缘先后封闭。

表 19 邱氏戈壁蹶鼠的上齿列测量 (单位: 毫米)

Table 19 Measurements of the upper tooth-row of *Gobiosminthus qiui* gen. et sp. nov. (in mm)

牙齿 / 标本号	M^1-M^3	M^1-M^2	M^2-M^3	M^1		M^2		M^3	
				长	宽	长	宽	长	宽
V10167	3.25	2.30	1.95	1.25	1.10	1.15	1.10	0.85	0.90

比较和讨论 正型标本上 M^1 的前侧有接触面,上颌骨上有前臼齿的齿槽,以及 M^1 的结构和形状,均说明它应属于林跳鼠科,而不会是仓鼠类。虽然这类动物的前臼齿和下臼齿性质目前尚不清楚(很可能在乌兰塔塔尔采集品中,就包含有这些牙齿,只是没有被区分出来而已),但从上臼齿特点看,无疑在本文归并到戈壁蹶鼠中的标本,代表了林跳科中的一个新类群。

新属戈壁蹶鼠与早期的林跳鼠类差别较大。在云南曲靖下渐新统中发现的三个属中,中华蹶鼠 (*Sinosminthus*) 的 M^1 和 M^2 具两条原脊,在原尖和前尖之间封闭成坑。

表 20 邱氏戈壁蹶鼠的单个牙齿测量(单位：毫米)

Table 20 Measurements of the isolated teeth of *Gobiosminthus qiui* gen. et sp. nov. (in mm)

牙齿	标本数	长			宽		
		最大值	最小值	平均值	最大值	最小值	平均值
M^1	8	1.35	1.05	1.25	1.25	0.90	1.13
M^2	1			1.25			1.10

晓蹶鼠（*Heosminthus*）虽也具一条原脊，但它的尖、脊的形态，特别是后尖不与后边脊相连，M^2 具原脊 I 而无原脊 II 可与新属相区别，而且个体也稍小一些。另一属异蹶鼠（*Allosminthus*）的齿尖钝，齿脊低而弱，中脊和下中脊不太发育，与新属显然不是一回事。中、晚渐新世亚洲的副蹶鼠可能是中华蹶鼠的后裔。戈壁蹶鼠以其 M^2 具原脊 II 而无原脊 I、和后尖与后边脊相连区别于副蹶鼠。它的 M^1 和 M^2 的后尖与后边脊相连区别于欧美的更新蹶鼠（*Plesiosminthus*）。戈壁蹶鼠上臼齿的深窄的沟谷是在其他林跳鼠中未曾见过的。

伍德（Wood, 1935）记述了发现在美国南达柯他州的 *Plesiosminthus grangeri*(原名为 *Schaubeumys grangeri*),标本之一为一M^2,从图中可以看出，该牙齿的前壁较斜，前尖明显地与原尖后臂连接形成原脊 II，这是林跳鼠科 M^1 的一般特征。它的后尖与次尖前臂相连，也与在德国 Gaimersheim 地点发现的 *Plesiosminthus myarion* 的 M^1 一致，因此笔者怀疑该牙齿是 M^1 而不是 M^2。若如此，它的后脊的连接情况与戈壁蹶鼠的完全不同。如果该牙齿确实是 M^2,那么它也与戈壁蹶鼠的不同，这不仅表现在后脊的连接形式，而且前者的脊形化程度不如后者强，沟谷也不象后者深窄。

甘肃党河发现的 T.b.557a（标本已丢失），步林（1946, p.25）记述为党河副蹶鼠。从步林所绘插图及描述看，它的后尖无疑问地与后边脊相连，笔者认为这个牙齿有可能属于戈壁蹶鼠。

? 戈壁蹶鼠未定种 ?*Gobiosminthus* sp.

(图版 II,3)

材料 UTL3：一左 M^2(V10308)。UTL4a：左 $M^2$1 个(V10309)。UTL4b：$M^2$4 个(V10310.1—4)。UTL6：$M^2$3 个(V10311：1—3)。

记述 这几个牙齿兼具 M^1 和 M^2 的特点。它们的前尖与原尖后臂相连形成原脊 II，而不象一般林跳鼠 M^2 那样具原脊 I。此外，它们的后尖与次尖相连的位置也不象一般 M^2 那样靠前。但这些牙齿前宽后窄，前壁有很大的齿间磨蚀面，完全是 M^2 的特征。步林（Bohlin, 1946, P.35）也曾记述过一个相似的牙齿（T.b.590a，长 1 毫米，宽小于 1 毫米），他认为很特殊，做了是 M^1 或 M^2 的两种分析，最后他倾向最可能是 M^1，他将前宽后窄的形状解释为是不寻常的牙齿，前面大的齿间磨蚀面是由前面乳齿造成的。戈壁蹶鼠的发现，有力地证明了步林记述的牙齿和乌兰塔塔尔这几个牙齿均是 M^2 而不是

表 21 ？戈壁蹶鼠未定种的牙齿测量(单位：毫米)

Table 21 Measurements of the cheek teeth of ?*Gobiosminthus* sp. (in mm)

牙齿	标本数	长			宽		
		最大值	最小值	平均值	最大值	最小值	平均值
M^2	9	1.30	0.90	1.10	1.25	0.80	0.98

M^1,同时说明了它们很可能也是戈壁蹶鼠。但与邱氏戈壁蹶鼠仍有一定的差别，它们的 M^2 的后尖似与次尖中部相接,而不是象后者那样靠后连在后边脊上。因此暂不定种。当然,也有可能它就是邱氏戈壁蹶鼠。

沙漠蹶鼠(新属) *Shamosminthus* gen. nov.

属的特征 上臼齿一般中尖大,磨蚀后成三角形。中脊自中尖至外侧通常渐细渐低。M^1 的后脊与次尖后臂相接并与后边脊间有纵脊相连。 M^2 具原脊 II 而无原脊 I。

属型种 童氏沙漠蹶鼠 (*Shamosminthus tongi* sp. nov.)。

包括种 仅一属型种。

童氏沙漠蹶鼠(新种) *Shamosminthus tongi* sp. nov.

(图版 II,5 -6;图 3)

正型标本 一残破的左上颌骨附颊齿 P^4-M^3(UTL8b, V10315)。

归入材料 UTL3：一右上齿列 M^1-M^2(V10312)；单个的 $M^1$4 个 (V10312.1—4)；$M^2$1 个(V10312.5)。UTL4a：右上齿列 M^1-M^2(V10313)；上齿列两个 (V10313.1-2)；单个的 $M^1$11 个(V10313.3—13)；$M^2$1 个(V10313.14)。UTL4b：单个的 $M^1$17 个(V10314.1—17)；M^2 两个 (V10314.18—19)。UTL8b：上齿列 3 个 (V10315.1—3)；单个的 $M^1$3 个 (V10315.4—6)。

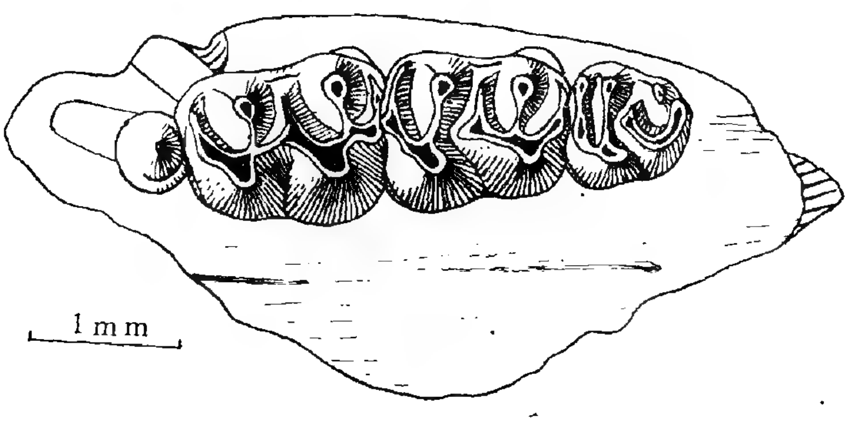

图 3 童氏沙漠蹶鼠的上颊齿 (V10315).

Fig. 3. The upper dentition of *Shamosminthus tongi* gen. et sp. nov. (V10315)

表 22　童氏沙漠蹶鼠的上齿列测量(单位：毫米)

Table 22　Measurements of the upper tooth-row of *Shamosminthus tongi* gen. et sp. nov. (in mm)

地点	标本号	P^4-M^3	P^4-M^2	P^4-M^1	M^1-M^3	M^1-M^2	M^2-M^3	P^4		M^1		M^2		M^3	
								长	宽	长	宽	长	宽	长	宽
UTL3	V10312					2.00				1.05	0.95	1.05	0.90		
UTL4a	V10313					2.15				1.15	1.10	1.05	0.95		
	.1					2.15				1.15	0.95	1.05	0.95		
	.2			1.35				0.35	0.35	1.05	0.85				
UTL8b	V10315	3.70	3.00	1.75	3.30	2.50	2.00	0.50	0.50	1.35	1.20	1.20	1.00	0.80	0.80
	.1		2.65	1.60		2.30		0.50	0.50	1.25	1.15	1.10	1.00		
	.2		2.55	1.60		2.20		0.50	0.50	1.20	0.95	1.05	0.95		
	.3			1.50				0.45	0.50	1.10	0.90				

表 23　童氏沙漠蹶鼠的单个牙齿测量(单位：毫米)

Table 23　Measurements of the isolated teeth of *Shamosminthus tongi* gen. et sp. nov. (in mm)

牙齿	标本数	长			宽		
		最大值	最小值	平均值	最大值	最小值	平均值
M^1	35	1.40	1.00	1.16	1.25	0.80	0.93
M^2	4	1.15	1.00	1.08	1.00	0.80	0.91

特征　同属的特征。

属种名释　属名表示这类动物发现在我国北方干燥的沙漠地带；种名赠予与作者多次讨论林跳鼠问题的童永生先生。

描述　P^4小，齿冠成蘑菇状，比齿根略宽大。主尖大，位于前外侧，在其后内和后外侧有一半圆形脊，脊与主尖之间以沟隔开。经过一定的磨蚀，脊的两端先后与主尖相连。总的说来，该牙齿的特征基本上与副蹶鼠的相似。

上臼齿脊形化程度相对较弱，连接尖之间的脊比较低细。

M^1 大致成长方形，长大于宽，一般前壁窄于后壁，但也有少量标本前、后壁宽度近等或后壁稍稍宽于前壁。原尖比较收缩，原尖前臂伸向前外与前边脊融合成牙齿前壁，在有些标本中前壁可见前边尖。前齿带低弱或不发育。原尖后臂与前尖相连成原脊 II，该脊在绝大部分标本中与原尖后臂对齐，比较平直，但也有个别标本该脊稍弯曲。中尖一般都很大，成三角锥形。中脊在绝大部分标本中均较短，且自中尖向外渐低渐细。次尖前臂与内脊相连，后臂与后尖连成后脊 II，并在中部与后边脊间有纵脊相连。在有些标本中，后边脊自中部后边尖处向两侧逐渐变低变细。由于原尖和次尖均比较收缩，故内中谷较开阔，次尖后的凹较明显。

M^2 也近长方形，但与 M^1 不同的是在绝大部分标本中后壁显著窄于前壁，当然也有极少数牙齿后壁接近或稍稍窄于前壁的。这个牙齿的边尖、边脊及中脊等的发育程度、中尖的大小及前尖与原尖的连接位置等方面均相似于 M^1，区别是后尖不是连于次尖后臂，而是与前臂或中部相连，且后脊与后边脊间无纵脊。

M^3 与前两牙齿不同，成方圆形，比例上也小得多。原尖后侧强烈收缩，原脊与原尖相连的位置比较靠前，应是原脊 I。前尖比在前两臼齿中细长得多。内脊近中，短，因此中尖和中脊很靠近原脊。中尖大，中脊短，且与前两臼齿一样，向边缘变细变低。次尖不象原尖那样收缩，前臂直接与中尖相连，后臂与后边脊融合。后尖小，成脊状。后脊低，似与次尖中部相连。由于次尖和原尖挨得很近，故两尖之间的内中谷很深窄，自谷口向前稍偏外伸。次尖之后牙齿无凹。

比较与讨论　沙漠蹶鼠虽在大小上接近党河副蹶鼠和小副蹶鼠（见测量表），但在特征上与包括这两种在内的副蹶鼠属有很大差别。它的上臼齿中尖大，中脊自中尖到边缘渐细渐低，M^1 后脊与后边脊之间有纵脊相连，M^2 具原脊 II 而无原脊 I。尽管欧洲的 *Plesiosminthus myarion* 的 M^2 的原尖和前尖的连接情况有些相似于新属，但新属上述其他方面的特点可以与更新蹶鼠相区别。虽然目前戈壁蹶鼠发现的材料还不算多，但沙漠蹶鼠与它的区别已相当明显，它们的上臼齿，前者脊形化程度弱，中尖大，而后者正相反。它们的 M^1，前者多是后壁宽于前壁，而后者从现有的标本看也相反。戈壁蹶鼠的 M^1 的后尖直接与后边脊相连，而沙漠蹶鼠是与次尖后臂相连，然后通过纵脊使后脊与后边脊相连。前者 M^2 的后尖也与后边脊相连，而后者则连于次尖前臂或中部。它们的 M^2 虽都具原脊 II 而无原脊 I，但戈壁蹶鼠的原脊 II 要比沙漠蹶鼠的原脊 II 在位置上靠后得多。沙漠蹶鼠与早渐新世的林跳鼠更易区别。它以 M^1 和 M^2 不具原脊 I、M^1 在后边脊和后脊之间具纵脊、上臼齿中尖大等特点区别于中华蹶鼠，以上臼齿中尖大、中脊向边缘渐细渐低、M^1 后脊与次尖后臂相连并与后边脊之间有纵脊、M^2 具原脊 II 而无

原脊 I 等区别于晓蹶鼠。异蹶鼠的上臼齿的中尖小、中脊极不发育，不同于包括沙漠蹶鼠在内的所有的林跳鼠。

二、问 题 讨 论

1. 关于早期仓鼠（cricetids）与林跳鼠的区别

林跳鼠和仓鼠是鼠形亚目中的两个科，由于它们早期成员牙齿的结构、尖脊的排列和连接方式等彼此非常相似，因此在采集物特别是由筛洗而获得的单个牙齿中，很难将它们区分。在本文研究过程中也同样碰到了这个难题。经过仔细观察和研究后，我们是以以下特点将这两类啮齿类加以区分的：1）如果有完整齿列的上颊齿，则仓鼠仅具 3 个上臼齿，而林跳鼠除 3 个上臼齿外，在 M^1 前还具一小的 P^4；2），如果有完整或部分下颌骨，则仓鼠的前颏孔的位置靠下，大致在骨体中部，而林跳鼠的前颏孔的位置相当靠上，接近下颌骨体的背侧；3）由于仓鼠不具 P^4，故 M^1 为上颌骨上的第一个牙齿，这样，它的形状与林跳鼠 M^1 的很不一样，在前尖前侧多出一很大的前叶；4）M_1 的下前边尖在林跳鼠中小而圆，在仓鼠中大，前圆后平，略成三角锥状；5）林跳鼠上臼齿的中脊发育，多伸至牙齿的外侧边缘，且多具中附尖，而亚洲的早期仓鼠上臼齿的中脊短，且自中尖起向外逐渐变细直至尖灭；6）下臼齿在林跳鼠中下中脊或假下中脊长，伸至边缘，多具下中附尖；而仓鼠下中脊短，其情形如同上臼齿。7）此外，臼齿特别是下臼齿的 4 个主尖，在林跳鼠中比较收缩，横向上相对较对齐成对尖，而在仓鼠中则收缩不显，横向上下原尖和下次尖比下后尖和下内尖靠后得多。

2. 关于含化石层的地质时代

在甘肃党河流域和内蒙古乌兰塔塔尔虽都发现了副蹶鼠属化石，但两地的林跳鼠仍有明显不同。除种类外（如沙漠蹶鼠，就现有的资料看，仅发现在乌兰塔塔尔地区），在同种动物的形态上也有一定的差异。如前所述，乌兰塔塔尔的副蹶鼠标本在形态特征上要比党河的复杂多样，这一方面说明甘肃党河地区尚没有发现足够的化石以示这个属的变异，也就是说，今后若有更多的副蹶鼠标本在该地区被发现，也可能会象在乌兰塔塔尔地区那样形态多种多样。另一方面，就目前情况看，在甘肃副蹶鼠亚洲种的材料少，难以判定，而党河种和小副蹶鼠的标本就比较多，但也没有表现形态复杂的情况，这或许说明两地同种动物的颊齿形态本来就有差别，甘肃的单一些。

从某些形态特征看，乌兰塔塔尔的副蹶鼠正处于早期林跳鼠和在甘肃发现的副蹶鼠的中间状态。如 M^1 的原尖前臂，在早渐新世中华蹶鼠中长，并与前尖相连形成原脊 I，保留了原始的双原脊形态。而在甘肃发现的副蹶鼠中，原尖前臂伸向前外角，与前边脊融合形成牙齿前壁。在乌兰塔塔尔发现的副蹶鼠两个大种中，既有与甘肃标本一致的情况，也有原尖前臂短，既不与前边脊也不与前尖相接，成游离状。极其个别的标本还保留了似中华蹶鼠的双原脊形态。这种过渡状况同样也表现在牙齿的齿根上。中华蹶鼠的 M^1 和 M^2 全为 3 根，在甘肃发现的副蹶鼠皆为 4 根，而在乌兰塔塔尔发现的副蹶鼠既有 3 根，又有 4 根，而且好多标本呈现了由 3 根向 4 根的过渡状态。很明显，乌兰塔塔尔的某些标本形

态要比甘肃的原始，但无疑又比中华蹶鼠的进步。甘肃产副蹶鼠化石地层的时代为晚渐新世（Bohlin, 1946; 王伴月等,1981）。因此，从林跳鼠类化石看，支持了乌兰塔塔尔含化石层的时代为中渐新世的观点。

3. 关于林跳鼠科早期属种的系统关系

林跳鼠是啮齿类中个体较小、有现生种的一个科。根据目前的资料，它最早出现在晚始新世，化石发现在我国山西的垣曲盆地。

早渐新世时，林跳鼠已有了很大的分化，出现了代表 3 个支系的 3 个属（Wang, 1985）。其中异蹶鼠最特化，牙齿齿尖大而明显，脊低，中脊和下中脊无或不发育。它在早渐新世后未留下后裔。中华蹶鼠与中、晚渐新世副蹶鼠、特别是两个大种最接近，之间有很多相似之处。它们的个体均较大，上门齿前侧无沟。虽然副蹶鼠的牙齿形态比较复杂，但也有与中华蹶鼠一样的：M^1 后尖与后边脊或次尖后臂相连，M^2 具两条原脊。然而它们之间的差别也很明显。中华蹶鼠 M^1 都具双原脊，而副蹶鼠基本上只具原脊 II；前者前面两个上臼齿均为 3 齿根，而后者有 3 根亦有 4 根；牙齿脊形化程度后者比前者强。这些不同点表明中华蹶鼠比副蹶鼠具原始性，后者可能是由前者发展而来。晓蹶鼠在已知的林跳鼠类中最接近更新蹶鼠，它们的 M^1 的原尖前臂不与前尖相连，后尖连于次尖中部，M^1 和 M^2 都具 3 齿根，个体均较小。但它们之间仍有许多不同，始晓蹶鼠（*Heosminthus primiveris*）的齿尖清楚，脊相对较低，M^1 的原尖前臂短，且接近前尖，上门齿前侧无沟等特点均不同于更新蹶鼠。不少差别显示了始晓蹶鼠比更新蹶鼠原始，前者很可能就是后者的祖先类型。

戈壁蹶鼠的个体较大，牙齿的脊形化程度强，M^1 的后尖与后边脊相连，在早渐新世 3 属林跳鼠中它最接近中华蹶鼠，但两者之间的差别仍相当明显。戈壁蹶鼠不象中华蹶鼠 M^1 那样具原脊 I，不仅 M^1 而且 M^2 的后尖都与后边脊相连，M^2 具原脊 II 而无原脊 I，单个的 M^2 很容易被误认为 M^1，这些特征表明它与中华蹶鼠有一定的继承性，同时又相当特化。如果在甘肃发现的 T.b.557a 号标本确是戈壁蹶鼠的话，那么这个属的地史分布就延续到晚渐新世。沙漠蹶鼠 M^1 的后尖与次尖后臂相连，在早渐新世三属蹶鼠中它最相似中华蹶鼠，表明它很可能是从中华蹶鼠或相近的类群进化而来。但它的上臼齿中尖大，中脊相对短，M^1 在后脊和后边脊之间有纵脊，M^2 具原脊 II 而无原脊 I，这些特点既不同于中华蹶鼠，也在许多方面不同于戈壁蹶鼠，它可能是中渐新世林跳鼠类的一绝灭旁支，在晚渐新世及其以后的年代里没有发现它的后裔。

在乌兰塔塔尔林跳鼠类化石发现之前，副蹶鼠仅限于甘肃，三个种中，小副蹶鼠与其他两种差别较大，它的个体小，M^1 后尖不与次尖后臂或后边脊相连，M^2 仅具原脊 I 而无原脊 II，这些方面给人以它可能是晓蹶鼠的印象。关于它的分类位置，王伴月（1985）在做了是中华蹶鼠—副蹶鼠和晓蹶鼠—更新蹶鼠支系两种可能的分析后，觉得还是放在副蹶鼠属中好。其不能放到晓蹶鼠支系的主要原因是下臼齿的形态和 M^1 及 M^2 为 4 齿根。从本文记述的乌兰塔塔尔材料看，小副蹶鼠的下臼齿（如 M_2），在有些标本中也具有长的下中脊和短的下后脊 II，两个前面的上臼齿既有 3 根又有 4 根，在这些方面似乎缩短了这个种与晓蹶鼠之间的距离。然而本文的研究还揭示了：副蹶鼠属中两个大种的牙齿

形态不象以前认为的那样单一，有的 M^1 的后尖与次尖中部相连，大部分 M^2 不具原脊 II，这正是小副蹶鼠这两个牙齿的典型式样；再者，在大小上，我们是按照前两个臼齿的长度分别大于 1.5 毫米和小于 1 毫米及其在其间来划分中亚种、小副蹶鼠和党河种的，然而在界线上的标本的归属很难确定，也就是说，这三个种在大小上也是连续和交错的。因此，无论从形态还是从个体大小看，小副蹶鼠应放在副蹶鼠属。

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ZAPODIDAE (RODENTIA, MAMMALIA) FROM THE MIDDLE OLIGOCENE OF ULANTATAL, NEI MONGOL

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Key words Ulantatal, Nei Mongol; Middle Oligocene; Zapodids

Summary

Ulantatal area is about 40 kilometers northwest to the county city Bayanhaote of Alxa Zuoqi, Nei Mongol, where a series of deposits con isting mainly of brown-reddish and yellow-reddish siltstone and sandy siltstone are exposed, wi h over one hundred meters in thickness. Early in 1977, fossil mammals were found here by a local geological team. More fossils were collected in 1978 by a field team from IVPP (Huang, 1978).

The Chinese and German scientists made an investigation in Ulantatal area in Autnmn of 1987 according to the agreement in paleontology between the Academia Sinica and the Max-Planck-Gesellchaft. During one month field work, eight localities from bottom to top of the strata in the area were scieenwashed for micromammals besides collecting fossils from the surface. The concentrate resulting from this screening has recently sorted and many small rodent specimens were obtained. Among these fosssils, zapodids were one of the dominant animals in the region and are dealt with in the present paper.

"UTL" is added before the number, showing the localities are in the Ulantatal area. Regarding the dental notation, upper case letters are used for upper teeth and lower case letters for lower teeth, e.g., M1 represents an upper first molar, m1 a lower first molar. The measurements are given in millimeters. The dental terminology used in this paper follows Bohlin (1946), Wang(1985) and Dienemann(1987).

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I. Systematic paleontology

Rodentia Bowdich, 1821

Zapodidae Coues, 1875

***Parasminthus* Bohlin, 1946**

The genus *Parasminthus*, including three species: *P. asiae centralis*, *P. tangigoli* and *P. par-*

vulus, was erected by Bohlin in 1946 based on the material found in Gansu (Kansu). Bohlin did not give diagnosis either for the genus or for the species. But from his description, the difference between the first two species is mainly the size. The first two species differ from the last one not only in size, but also in tooth structure. In *P. parvulus* the metaloph of M1 does not connect with the posteroloph or the posterior arm of the hypocone, and protoloph II is absent on M2. According to Bohlin's descriptions and material from Ulantatal, diagnosis of the genus *Parasminthus* are as follows: small to medium-sized zapodids, no groove on anterior surface of the upper incisor, metaloph of M1 connecting with middle or posterior arm of hypocone, or posteroloph, M2 having one or two protolophs, M1 or M2 possessing three or four roots.

Parasminthus asiae-centralis Bohlin, 1946

Specimens UTL3: 4 isolated M1 (V10 31.4); 1 m3 (V10131.5). UT14a: 1 P4 (V 10132.1); 4 M1 (V10132.2—5); 3 M2 (V10132.6—8); 1 M3 (V10132.9); 5 m1 (V10132.10—14); 5 m2 (V10132.15—19); 1 m3 (V10132.20). UTL4b: A left maxillary fragment with P4-M1 (V10133); 3 isolated P4 (V10133.1—3); 19 M1 (V10133.4—22); 5 M2 (V10133.23—27); 15 M3 (V10133.28—42); 8 m1 (V10133.43—50); 13 m2 (V10133.51—63); 10 m3 (V10133.64—73). UTL6: 1 M2 (V10134). UTL7a: 1 P4 (V10135.1); 5 M1 (V10135.2—6); 5 M2 (V10135.7—11); 2 m1 (V10135.12—13); 5 m2 (V10135.14—18). UTL7b: A right maxillary fragment with P4-M2 (V10136); a left lower jaw with m1-m3 (V10136.1); 5 isolated M1 (V10136.2—6); 3 M2 (V10136.7—9); 8 M3 (V1013.10—17); 5 m1 (V10136.18—22); 4 m2 (V10136.23—26); 15 m3 (V10136.27—41). UTL8b: A left lower jaw with m1-m3 (V10137); 2 isolated M1 (V10137.1—2); 2 M2 (V10137.3—4); 1 m2 (V10137.5); 1 m3 (V10137.6).

Improved diagnosis Big-sized *Parasminthus* (each of first two molars over 1.5 mm. long); metaloph of M1 linking with posteroloph or posterior arm of hypocone in about 50% of the specimens, linking with central side in other half teeth; M2 having two protolophs in about 1/3 teeth, in the rest protoloph II short or absent; above two teeth possessing four roots in nearly 2/3 specimens, in the others having three or transitional roots from three to four.

Description When he established *P. asiae-centralis* Bohlin handled only 4—5 specimens with 7—8 teeth. No much individual variation the species could be approached. Now big variation have come to light in near 200 teeth from Ulantatal area.

P4 is small, bud-like, with crown slightly wider than root. There is a main cusp on the anteroexternal part of the crown. A semilunar crest goes from the posteroexternal through the posterointernal to the anteroexternal parts of the crown, separated from the main cusp by a semilunar groove. After some wear, this crest will connect with the main cusp on two margins.

M1 is roughly rectangular in outline, slightly longer than wide. In V10136 specimen, the anterior wall is relatively wider than the posterior one, while in V10133 the posterior wall is slightly wider than the anterior one. In the other isolated teeth, width of the anterior wall relate to the posterior one is variable from wide to narrow. Among four main cusps, the protocone and hypocone are anteriorly situated in comparison with the paracone and metacone, respectively. The anterior arm of the protocone extends anteroexternally and combines with the anteroloph at the middle point. But in a few specimens the anterior arm of the protocone fails to connect with the anteroloph. The posterior arm of the protocone joins the paracone, forming protoloph II. The paracone is big and high. The entoloph situates in the middle of the tooth, slightly anteroexternal-posterointernal direction. The mesoloph is quite developed, extending straightly and transversely from the mesocone to the external side of the tooth. There is

a mesostyle in most of specimens. The anterior arm of the hypocone conbines with the entoloph· The metacone links with the central side or posterior arm of the hypococe, or the posteroloph, and the percentage of the connection in specemens is shown in table 2. Owing to the constriction of the posterior wall of the protocone, the anterior wall the entosinus is very steep, while the posterior wall is gently sloped.

M2 is also rectangular in shape, slightly longer than wide. Its anterior wall is always broader than the posterior one though in some teeth they are nearly equal. In some specimens there is only protoloph I and no protoloph II. In a few teeth there are double protolophs forming a lake between the paracone and protocone. In some specimens, however, the protoloph II is present but very weak (see table 3). The metaloph connects with anterior arm or middle part of the hypocone, and never links with the posterior arm of the hypocone or the posteroloph.

M3 is different from the preceding molars not only in shape and size but also in structure, and has big variation. Owing to pronounced constriction of the posterior wall, most of the teeth are roughly triangular in outline. The protocone is big, occupying the anterointernal part of the crown. The paracone is high but not robust. The protoloph is transverse and straight. The entoloph is short, slightly anterointernal-posteroexternal direction, usually extending from the point of the protoloph very near the protocone, but in some specimens extending directly from the protocone. There is a connection between he protocone and hypocone in the inner side of the tooth, so the entosinus is close in most of the specimens. The mesoloph, metaloph and posteroloph are very near each another.

ml is rectangular in outline with slightly narrow anterior wall. The protoconid and hypoconid are more posteriorly situated than the metaconid and entoconid, respectively. The anteroconid is rounded, much smaller and lower than the main cusps. Between the protoconid and metaconid exists metalophid II. The ectolophid extends posterointernally from the posteroexternal side of the protoconid. The mesoconid s small but distinct. The mesolophid is very developed in general, extending straightly from he mesoconid to the inner side of the tooth and connecting with the mesostylid. In a few specimens there is a low and short ectomesolophid besides mesolophid. The sinusid is wide externally and narrow internally. The hypolophid joins anterior arm of the hypoconid, forming hypolophid I. The posterior arm of the hypoconid connects with the posterolophid. The posterolophid links with posterointernal side of the entoconid, so the posterosinusid is closed.

m2 is also rectangular in shape. In some specimens the anterior arm of the protoconid and the metaconid connect with the anterolophid, respectively, while in other teeth they connect with the anterolophid via a longitudinal crest. The development of the posterior arm of the protoconid and the mesolophid can be divided into five condition; 1. The posterior arm of the protoconid is not projecting beyond the ectolophid and the mesolophid is strong; 2. The posterior arm of the protoconid is weak and the mesolophid is strong; 3. The posterior arm of the protoconid connects with the posterior side of the metaconid and forms metalophid II, the mesolophid is still strong; 4. The posterior arm of the protoconid combines with the mesolophid; 5. The mesolophid is poorly developed, the posterior arm of the protoconid is long and forms a pseudomesolophid (see table 5). Other features of m2 are similar to those of. ml.

m3 is small in comparison with other two lower molars, roughly rectangular with distinct short posterior wall. It differs from m2 mainly in: the posterior arm of the protoconid is extremely developed and forms pseudomesoloph d; there is a crest connecting the inner sides of

the inner cusps (metaconid etc.), so the inner sinusids are all closed.

The roots of the teeth are as follows: P4 is single-rooted; M3 is three-rooted; the lower molars are all double-rooted; M1 and M2 have two labial roots and lingual ones variable from one to two.

Remarks The cheek teeth from Ulanta al are the same to those of *Parasminthus asiae-centralis* both in size and some features, but complicated in morphology. In the material of *P. asiae-centralis* from Gansu the metaloph of M1 connects with the posteroloph or posterior arm of the hypocone, while in Ulantatal material it joins the middle part of the hypocone besides the above condition. In the former M2 possesses two protolophs, while in the latter it has two or one. Both M1 and M2 in the former have four roots while in the latter they have four or three.

The differences mentioned above, however, can hardly be warrantable to separate them into different species. The reasons for these are: 1. The tooth size is nearly the same in two areas; 2. The morphology of the cheek teeth from Gansu lies well within the variation of the tooth structure from Ulantatal; 3. The connection of the metaloph of M1, the number of protolophs of M2, the development of the mesolophid and the posterior arm of the protoconid of m2, and root number as well as the developmental condition are all variable and transitional; 4. Teeth in the same tooth row show different characters, for or against the original diagnosis of *P. asiae-centralis*. Take V10136 specimen for instance, the metaloph of M1 is similar to that of type specimen (T. b. 593b) of *P. asiae-centralis* in connecting with the posteroloph, but M2 is distinguishable from that of type specimen in the presence of only one protoloph. ao it is rather suitable to place all the specimens studied in one species, *P. asiae-centralis*.

Parasminthus tangingoli Bohlin, 1946

Material UTL 3: 4 isolated M1 (V10151.1—4); 7 M2 (V10151.5—11); 3 M3 (V10151.12 14); 13 m1 (V10151.15—27); 4 m2 (V10151.28—31). UTL 4a: A maxillary fragment with P^4-M^3 (V10152); 4 upper tooth rows (V10152.1—4); 3 lower tooth rows (V10152.5—7); 6 isolated P4 (V10152.8—13); 69 M1 (V10152.14—82); 43 M2 (V10152.83—125); 3 M3 (V10152.126—128); 37 m1 (V10152.129—165); 36 m2 (V10152.166—201); 9 m3 (V10152.202—210). UTL 4b: A right broken upper jaw with P4-M1 (V10153); 3 maxillary fragments (V10153.1—3); 4 lower tooth rows (V10153.4—7); 12 isolated P4 (V10153.8—19); 137 M1 (V10153.20—156); 82 M2 (V10153.157—238); 13 M3 (V10153.239—251); 142 m1 (V10153.252—393); 110 m2 (V10153.394—503); 25 m3 (V10153.504—528). UTL 6: 1 isolated P4 (V10154.1); 3 M1 (V10154.2—4); 2 M3 (V10154.5 6); 14 m1(V10154.7 20); 5 m2 (V10154.21 -25); 2 m3 (V10154.26—27). UTL 7a: A lower tooth row (V10155); 1 isolated P4(V10155.1); 16 M1 (V10155.2—17); 10 M2 (V 10155.18—27); 20 m1 (V10155.28—47); 13 m2 (V10155.48—60). UTL 7b: A right fragmentary upper jaw with M1-M2 (V10156); 1 upper tooth row (V10156.1); 3 lower tooth rows (V10156.2—4); 10 isolated M1 (V10156.5—14); 5 M2 (V10156.15—19); 8 M3 (V10156.20—27); 12 m1 (V10156.28-39); 7 m2 (V10156.40—46); 7m3 (V10156.47—53). UTL 8b: A left broken upper jaw with P4—M2 (V10157); 2 upper tooth rows (V10157.1—2); 5 lower tooth rows (V 10157.3—7); 6 isolated M1 (V10157.8—13); 6 M2 (V10157.14—19); 3 m1 (V10157.20—22); 3 m2 (V10157.23025); 2 m3 (V10157.26—27).

Improved diagnosis medium-sized *Parasminthus* with length roughly between 1.5 to 1.0 mm for first and second molar. Metaloph of M1 in most of specimens joining central side of hypocone, only in a few teeth linking with posterior arm of hypocone or posteroloph. M2 possessing double protolophs only in 10% specimens. Each of above two teeth having four roots

in about 20% specimens.

Description P4 is similar to that of *P. asiae-centralis* in structure but smaller in size. M1 in some specimens is nearly quadrate in outline while in other specimens it is rectangular. In general the anterior and posterior walls are equal in width or the former is somewhat narrower than the latter. But in a few teerh the anterior wall is wider than the posterior one. In most of specimens the anterior arm of the protocone joins the anteroloph, but in a few teeth the anterior arm extends straightly to the anteroexternal corner, separating from the anteroloph by a groove. The posterior arm of the protocone links with the paracone, forming protoloph II. The mesocone is relatively smaller but distinct. The mesoloph extends transversely and straightly from the mesocone to the mesostyle or the external side of the tooth. The metaloph connects with the central side of the hypocone except for a few specimens, in which it links with the posterior arm or the posteroloph.

M2 has nearly the same shape with that of *P. a siae-centralis*, roughly being quadrate or rectangular, with slightly wide anterior wall. It differs from M1 in having protoloph I. In some specimens it also possesses protoloph II(see table 9). The metaloph joins anterior arm or central side of the hypocone, and never links with the posterior arm.

M3 is round-quadrate in outline with nearly equal length and width. The protocone is very constrictive but still large. The paracone is the second biggest cusp of the tooth. There is a protoloph I and no protoloph II. The entoloph is short, extending from the point of protoloph very near the protocone. The mesocone is small but distinct. The mesoloph extends from the mesocone to the external side of the tooth. The mesostyle is weak in most of specimens. The hypocone is small. The metacone is crest-like and combines with the posteroloph. The posteroloph connects with the anterior arm of the hypocone. After some wear, the entosinus is closed.

The masseteric fossa is deep, with distinct masseteric crest, terminating anteriorly below m1. The mental foramen situates right anterior to m1 and near the back of the horizontal part of ramus of the mandiple. The vertical part of ramus of the mandible extends from the posterior margin of m2.

m1 is longer than wide, with broad posterior wall. The anteroconid is small and round, situating in the middle of the anterolophid, and lower than the four main cusps. The protoconid and metaconid are nearly in the same line transversely, closer to each other than the hypoconid and entoconid. The hypoconid is more posteriorly situated than the entoconid. There is only short metalophid II present. The ectolophid extends from the posterior side of the protoconid posterointernally to the mesoconid. The mesoconid is relatively large, more anteriorly situated in some specimens. In that case the mesolophid is much closer to the metalophid II. The mesolophid extends transversely and stratightly to the mesostylid in most of specimens. In some teeth, however, the mesostylid is indistinct. The hypolophid connects with the ectolophid right anterior to the anterior arm of the hypocond. The posterior arm of the hypoconid is incorporated in the posterolophid, forming a robust crest, then links with the posterior side of the entoconid, closing the posterosinusid.

m2 is rectangular in outline, longer than wide, with nearly equal width of the anterior and posterior walls. The protoconid is slightly posteriorly situated in comparison with the metaconid. Both conids separate from the anterolophid by grooves. The metaconid and the anterior arm of the protoconid link with a longitudinal crest which then connects with the middle of the anterolophid. So the metalophid I is not straight but convex anteriorly. The developmental condition of the mesolophid and the posterior arm of the protoconid shows in table

11., Other features of the posterior part of m2 are. similar to those of m1.

m3 has a wide anterior wall and distinctly narrow posterior one. The posterior arm of the protoconid is more developed, extending to the nner side of the tooth and forming a pseudo-mesolophid. There is no mesoconid and real mesolophid. The ectolophid. extends posterointernally from the posterior arm of the protoconid. The entoconid is very small and joins the anterior arm of the hypoconid, forming hypolophid I. The condition of the roots of M1 and M2 is similar to that of *P. asiae-centralis* and is shown in table 13.

Remarks As mentioned above, the mor hology of the cheek teeth found in Ulantatal is more complicated than that of *Parasminthus tangingoli* from Gansu, the same case like *P. asiae-centralis*.

P. asiae-centralis and *P. tangingoli* were nearly the same in morphology but different only in size was thought by Bohlin (Bohlin, 1946, p.43). The fact revealed by the Ulantatal material that the differences between the two species are not only in size but also in tooth structure. The metaloph of M1 is connected with the posterior arm of hypocone or the posteroloph in about half of the specimens, and with the central side of hypocone in the rest in *P. asiae-centralis*, while it is connected with the posterior arm or the posteroloph in a few teeth in *P. tangingoli*. Two protolophs are present in about one-third of M2 in the former species, but only one tenth in the latter. In the former four roots are present in about 70% of M1 and M2 while in the latter in only 20% of above teeth. The condition demonstrates that the percentage of metaloph connecting with posteroloph or posterior arm of hypocone on M1, having two protolophs on M2, and four roots of M1 or M2 is much higher in *Parasminthus asiae-centralis* than in *P. tangingoli*.

Parasminthus parvulus Bohlin, 1946

Material UTL 3: 2 isolated P4 (V10158.1—2); 8 M1 (V10158.3—10); 2 M2 (V (10158.11—12); 1 M3 (V10158.13); 6 m1 (V10158.14—19); 7 m2 (V10158.20—26); 5 m3 (V 10158.27—31). UTL 4a: A maxillary fragment with P4-M1 (V10159); 4 upper tooth rows (V 10159.1—4); 4 lower tooth rows(V10159.5—8); 3 isolated P4 (V10159.9—11); 60 M1 (V10159.12 —71); 31 M2 (V10159.72—102); 1 M3 (V10159.103); 53m1 (V10159.104—156); 48m2 (V10159. 157—204). UTL 4b: a broken upper jaw with M1-M3 (V10160); 7 upper tooth rows (V10160.1 —7); 6 lower tooth rows (V10160.8—13); 12 isolated P4 (V10160.14—25); 203 M1 (V10160. 26—228); 153 M2 (V10160.229—381); 23 M3 (V10160.382—404); 189 m1 (V10160.405—593); 174 m2 (V10160.594—767); 54 m3 (V10160.768—821). UTL 6: 3 isolated P4 (V10161.1—3); 62 M1 (V10161.4—65); 72 M2 (V10161.66—137); 5 M3 (V10161.1380142); 65 m1 (V10161.143—207); 64 m2 (V10161.208—271); 27 m3 (V10161.272—298). UTL 7a: A maxillary fragment with M1-M3 (V10162); 1 upper tooth row (V10162.1); 3 lower tooth rows (V10162.2—4); 1 isolated P4 (V10162.5); 22 M1 (V10162.6—27); 23 M2 (V10162.28—50); 36 m1 (V10162.51 86); 26 m2 (V10162.87—112). UTL 7b: A broken upper jaw with P4-M1 (V10163); 2 upper tooth rows (V10163.1—2); 4 lower tooth rows (V10163.3—6); 2 isolated P4 (V10163.7—8); 24 M1 (V10163.9—32); 20 M2 (V10163.33—52); M3 (V10163.53); 20 m1 (V10163.54—73); 11 m2 (V10163.7—84); 2 m3 (V10163.85—86). UTL 8b: A broken lower jaw with m1-m3 (V10164); 1 lower tooth row (V10164.1); 2 isolated M1 (V10164.2—3); 8 M2 (V10164.4—11); 2m1 (V10164.12—13); 1 m2 (V10164.14).

Improved diagnosis Small-sized *Parasminthus* with length of each of the first two molars being 1 or less than 1 mm long. Metaloph of M1 essentially connecting with central side

of hypocone No protoloph II on M2.

Description P4 is similar to that of other zapodids, small, crown being bud-like and somewhat broader than root, consisting of a main cusp and a semilunar posteroloph The size of P4 is variable. For instance, M1 on V10133.12 is larger than that on V10133.13, nevertheless P4 on V10133.12 is smaller than that on V10133.13. So P4 of this species has relatively stable structure but changeable size.

M1 is roughly rectangular or quadrate in outline. The anterior wall is equal to, wider or narrower than the posterior one. The anterior cingulum in some specimens is comparatively developed but lower, as high as P4 on the tooth row. The anterior arm of protocone extends straightly to the anteroexternal corner and forms anterior wall of the tooth, the posterior arm extends posteroexternally and links with paracone, forming a protoloph II. The mesocone is medium-sized. The mesoloph is very developed, robust and transverse in most specimens. The development of mesostyle is variable, from weak to strong. The metaloph connects with the middle part of the hypocone in general. The posterior arm of the hypocone combines with the posteroloph.

M2 is roughly rectangular in shape, with wide anterior wall. The anterior arm of the protocone extends anteroexternally and connects with the mid-point of the anteroloph in most of specimens. The protoloph links with the protocone rather anteriorly, so it is called here protoloph I. There is no protoloph II. The metaloph joins the anterior arm of the hypocone. Other features of the tooth are similar to these of M1.

M3 is irregular and round-quadrate in ou line with narrow posterior wall in most specimens. The protocone is large and contracted transversely. The protoloph links with protocone more anteriorly though the anterior arm of the protocone combines with the anteroloph. In some specimens there is no anterior part of en oloph, that is no crest between the protoloph and the mesoloph. The mesocone is small. The mesoloph is distinct, parallel to the metaloph in some specimens. The metacone and hypocone are relatively small. The metaloph links with anterior arm of the hypocone, forming metaloph I. The posterior arm of the hypocone combines with the posteroloph. The external cingulum is rather developed and forms lower crest-like margin of the tooth, closing the external sinuses. Owing to the presence of connection in the inner side of protocone and hypocone, the entosinus is often closed in many specimens.

All the lower jaws are not in good preservation. The anterior margin of the masseteric fossa terminates anteriorly below the posterior part of m1. The mental foramen is situated anterior to m1, near the back of the horizontal ramus. The cross section of the lower incisor is elliptic with anteroposterior long axis. The enamel covers 1/3 surface of the tooth.

m1 is nearly rectangular in outline, with wide posterior wall. The anteroconid is small and rounded, lower than not only the main cusps but also the metalophid and hypolophid, nearly as high as the mesolophid. The metaconid is as high and big as the protoconid. Between above two conids exists the metalophid II, which is concave in the middle and convex posteriorly. The ectolophid extends posteriorly from the point of the metalophid near the outside. The mesoconid is relatively large. The mesolophid is rather developed, transverse, extending from the mesoconid to the inner side of the tooth. The mesostylid is distinct in most of specimens. The ectomesolophid exists in a few specimens but very short and weak. The hypolophid connects with the anterior arm of the hypoconid. The posterior arm of the hypoconid combines with the posterolophid.

m2 is rectangular in outline, longer than wide. The anterior arm of the protoconid and the

metaconid connect with the anteroconid directly or through a longitudinal crest. The protoconid and metaconid are separated from the anterolophid by a groove. The condition of the posterior arm of protoconid and the mesolophid is similar to that in other species of *Parasminthus*, but the percentage of having pseudomesolophid is higher (see table 17). The features of the rear part of the tooth are similar to those of m1.

m3 has distinct narrow posterior wall. There is a big variation in tooth morphology. Take the posterior arm of the protoconid for instance, in some specimens it is very developed, extending to the inner side of the tooth, while in other specimens it is very short. The mesoconid is indistinct. There is no real mesolophid either. The hypolophid links with anterior arm of the hypoconid in some specimens, while in the others it joins the ectolophid anterior to the hypoconid. The anterior wall of the hypoconid contracts distinctly, so ectosinusid extends far posterointernally. The posterior arm of the hypoconid is incorporated in the posterolophid, and links with the posterointernal side of entoconid, closing the posterosinusid.

Remarks *Parasminthus parvulus* can b distinguished from the two bigger species of *Parasminthus* by not only size but also tooth structure. In *P. asiae-centralis* metacone of M1 connects with posterior arm of hypocone or posteroloph in about half specimens, in *P. tangingoli* a few teeth maintain this condition, while in *P. parvulus* it joins central side of hypocone in nearly all specimens. M2 possesses two protolophs in about one third specimens in *P. asiae-centralis*, about one tenth in *P. tangingol*, while in *P. parvulus* it has only protoloph I. m2 has two metalophs in about one third specimens in the two bigger species, while in *P. parvulus* this condition is in only one tenth specimens.

Gobiosminthus gen. nov.

Diagnosis of the genus Upper chee teeth strongly lophodont, groove and valley of the tooth deep and narrow. Metaloph of both M1 and M2 links with posteroloph. Protoloph of M2 joins posterior arm of protocone forming protoloph II, like that of M1.

Type species *Gobiosminthus qiui*, sp. nov.

Included species type species and ?*Gobiosminthus* sp..

Gobiosminthus qiui sp. nov.

Type A right maxillary fragment with M1-M3 (V10167, UTL7a);

Referred specimens UTL 4a: 2 isolaed M1 (V10165.1—2); UTL 4b: 5 isolated M1 (V10166.1—5); 2 M2 (V10166.6—7). UTL 7a: M1 (V10167.1).

Diagnosis As for the genus.

Etymology "Gobi" means desert, repr senting the genus was found in the desert of Nei Mongol; the species' name is given to Dr.Qiu Zhuding for his help during the study.

Description M1 is nearly quadrate in outline, slightly longer than wide. The anterior cingulum is low and weak, distinctly in front of protocone. The anterior arm of the protocone is robust, extending anteroexternally and meeting with the anteroloph. The posterior arm of the protocone extends posterointernally and connects with the paracone forming protoloph II. The mesoloph is strong and transverse, extending from the mesocone to the external side of the tooth. The metaloph links with the posteroloph. The anterior arm of the hypocone is strong, extending to the mesocone. The posterior arm of the hypocone is weak, extending posteroexternally and meeting with the posteroloph. There are four sinuses on the external side

and only one, entosinus, on the internal. Owing to the developed cusps and crests, the above sinuses are very deep and narrow.

M2 is rectangular in shape, longer than wide, with somewhat narrow posterior wall. Like M1, it has protoloph II and no protoloph I. T e metaloph also links with the posteroloph.

M3 differs from the preceding molars both in shape and structure. It is rounded-equilateral triangular in outline, roughly can be divided into anterior, posterointernal and postero-external walls. Both the protocone and paracone are large. The protoloph is robust, slightly convex anteriorly in the middle. Between the paracone and the anteroloph there is a distinct groove. The groove in front of the mesoloph links with the entosinus. Owing to the rather narrow entosinus, the hypocone and protocone are very near each other. The hypocone connects with the mesoloph, forming a crest like the protoloph. Between this crest and the metacone there is a semilunar lake. The posterior arm of the hypocone connects with the posteroloph. By some wear, all sinuses are closed one after another.

Comparison M1 on the type specime has front wearing surface, on the maxillary fragment there is an alveolus in front of M1, as well as the shape and structure of M1, indicate that the type specimen should belong to zapodid. Though the premolar and the lower molar of this animal have not known, based on the upper molar the specimens studied undoubtedly represent a new form of Zapodidae—*Gobiosminthus qiui*.

Gobiosminthus distinctly differs from the Early Oligocene zapodids. Both M1 and M2 of *Sinosminthus* have two protolophs, forming a lake between the protocone and paracone, and metaloph of M2 never connects with the posteroloph. Though *Heosminthus* also has only one protoloph on M1 and M2, the metaloph does not link with the posteroloph, and its M2 has protoloph I but no protoloph II. Allosminthus has obtuse cusp, lower and weak crest, not developed mesoloph etc., which are quite different from *G. qiui*. By above features we are able to distinguish the three Early Oligocene genera and the new form. *Gobiosminthus* differs from *Parasminthus* by having protoloph II and no protoloph I, and the metaloph connecting with the posteroloph on M2; and differs from *Plesiosminthus* by the metaloph of both M1 and M2 links with the posteroloph. *Gobiosminthus* differs from all the Oligocene zapodids by its deep and narrow grooves and sinuses on upper molars.

?*Gobiosminthus* sp.

Material UTL 3: 1 isolated M2 (V103 8). UTL 4a: 1 M2 (V10139). UTL 4b: 4 M2 (V10310.1—4). UTL 6: 3 M2 (V10311.1—3).

Description Above teeth have the cha acters of both M1 and M2. The paracone of the teeth connects with the posterior arm of the protocone forming protoloph II, the metaloph links with the hypocone also not as anteriorly as that on M2. But these teeth possess wide nterior wall and narrow posterior one, and large wearing surface on the anterior wall. All these indicate that they should belong to M2. Bohlin (1946, p. 35) also described a tooth (T. b. 590 a) found in Gansu. He thought this tooth was very special. After the made two possibilities of M1 or M2, Bohlin guessed the tooth might be M1. He explained that big wearing surface on the anterior wall was caused by deciduous tooth in front of it, and broad anterior wall was not normal condition. Discovery of *Gobiosminthus* demonstrates that both Bohlin"s tooth and specimens studied in the present paper all belong to M2, and may belong to *Gobiosminthus* But the metaloph of these teeth connects with the middle part of the hypocone, which is different from that of *Gobiosminthus qiui*.

Shamosminthus gen. nov.

Diagnosis of the genus Mesocone of upper molar large, triangular in cross section. Mesoloph extends from mesocone to outside gradually thinner and lower. Metaloph of M1 connects with posterior arm of hypocone forming metaloph II, which links with posteroloph by a longitudinal crest. M2 has protoloph II and no protoloph I.

Type species *Shamosminthus tongi* sp. nov.

Included species type species only.

Shamosminthus tongi sp. nov.

Type A maxillary fragment with P4-M3 (V10315, UTL8b).

Referred specimens UTL 3: A right maxillary fragment with M1-M3 (V10312); 4 isolated M1 (V10312.1 -4); 1 M2 (V10312.5). UTL 4a: A right upper jaw with M1-M2 (V 10313). 2 upper tooth rows (V10313.1—2); 11 isolated M1 (V10313.3—13); 1 M2 (V10313.14). UTL 4b: 17 isolated M1 (V10314.1—17); 2 M2 (V10134.18—19). UTL 8b: 3 upper tooth rows (V10315.1—3); 3 isolated M1 (V10315.4—6).

Diagnosis As for the genus.

Etymology "Shamo" also means desert in Chinese, indicating the fossils were found in the dry area of North China; The species' name is given to Dr. Tong Yongsheng, who helped the author a lot during the study.

Description P4 is small, mushroom-like crown. The main cusp is large, situating on the anteroexternal corner of the crown and separating from the posteroloph (a semilunar crest) by a groove. After some wear, the two ends of the posteroloph join the main cusp one after other.

M1 is roughly rectangular, longer than wide. The posterior wall is wider than the anterior One in most of specimens, but in a few teeth the posterior wall is slightly broad or the two walls are nearly equal in width. The protocone contracts anteroposteriorly. Its anterior arm links with the anteroloph, while the posterior arm joins the paracone forming protoloph II. The mesocone is large, triangular in cross section. The mesoloph is relatively short, extending thinner and lower outward. The anterior arm of the hypocone connects with the entoloph, while the posterior arm links with the metacone forming metaloph II, which joining the posteroloph by a longitudinal crest. The sinus behind the hypocone is distinct because of the contraction of the hypocone.

M2 is also nearly rectangular in outline, with the wide anterior wall. The structure of the tooth is similar to that of M1, differs only in: the metaloph does not connect with the posterior arm of the hypocone but the anterior one, and there is no longitudinal crest between the metaloph and the posteroloph.

M3 differs from the preceding teeth both in shape and structure. It is round-quadrate in outline and small in proportion with the other molars. The paracone connects with the protocone rather anteriorly, so it is called protoloph I. The paracone is thinner than that of the preceding molars. The entoloph is short and in the middle of the tooth, so the mesocone and the mesoloph are very near the protoloph. The mesocone is big and the mesoloph is short, like that of other molars, extending thinner and lower from the mesocone to the outside of the tooth. The anterior arm of the hypocone links with the mesoloph and the posterior arm com-

bines with the posteroloph. The metacone is low, linking with the middle part of the hypocone. The entosinus is very deep and narrow as the hypocone and protocone are very near.

Comparison *Shamosminthus* differs greatly from *Parasminthus* though its size is nearly the same with that of *P. tangingoli*. In *Shamosminthus* the mesocone is big, the mesoloph extends gradually thinner and lower from the mesocone to the outside of the tooth, there is a longitudinal crest between the metaloph and the posterolophon M', on M2 there is protoloph II and no protoloph I. *Shamosminthus* differs from *plesiosminthus* by above features though the protoloph of its M2 is somewhat like that of *Plesiosminthus myarion*. *In Shamosminthus* the upper molars are less lophodont, the mesocone is large, on. M1 there is a longitudinal crest between the metaloph and the posteroloph, on M2 the metaloph connects with anterior arm of the hypocone. All above characters are different from those of *Gobiosminthus*. *Shamosminthus* distinguishes from *Sinosminthus* in: no protoloph I and having longitudinal crest between the metaloph and the posteroloph on M1, big mesocone and special mesoloph. It differs from *Heosminthus* also by big mesocone, special mesoloph, the metaloph of M1 connecting with the posterior arm of the hypocone and has a longitudinal crest, having protoloph II and no protoloph I on M2. *Allosminthus* possesses small mesocone, weak mesoloph, differing from all the early zapodids including *Shamosminthus*.

II. Discussion

1. About the difference between the early zapodids and cricetids

Zapodidae and Cricetidae are two families of Myomorpha. Their early members are so similar in tooth morphology that it is really difficult to distinguish, especially the isolated teeth obtained from screenwashing. We encountered this problem in the study. After careful observation, it seems that there are following differences between the two forms: 1). In cricetids the front mental foramen is in the middle of the horizontal ramus, while in the zapodids it is near the back of the ramus. 2) In the former, M1 has big anterior lobe as it possesses no P4, while in zapodids M1 has no anterior lobe.3). The anteroconid of m1 in zapodids is small and rounded, while in the cricetds it is relatively large with rounded anterior wall and flat posterior one. 4). The mesoloph of upper molars in zapodids is more developed, extending from the mesocone to the external side of the tooth, and having mesostyle in general, while in the cricetids it is short, extending gradually thinner and lower from the mesocone. 5). Like upper molars, the mesolophid of the lower molars in cricetids is short, while in zapodids it (or pseudomesolophid) is more developed. 6). The main cusps of the molars, especially of the lower molars, in zapodids are more contracted, relatively in the same position transversely, while in cricetids they are less contracted, the protocone and hypocone are more posteriorly situated than the mesoconid and entoconid, respectively.

2. The fossil zapodids in Gansu and in Nei Mongol areas

Shamosminthus as well as *Gobiosminthus* so far known have been only recorded in Ulantatal, Nei Mongol though *Parasminthus* is occurred both in Ulantatal and Gansu. Between the two ares the morphology of the same species exists some differences other than the differentiation in taxa. The tooth structure of *Parasminthus'* species is more complicated in Ulantatal than in Gansu, which may indicate that there have been not enough specimens to be found to show the variation of the genus in Gansu. The morphology of *Parasminthus* in Gansu will be as complicated as in Ulantatal when more material is found. On the other hand, the

morphological differences of the same species together with the different number of roots in M1 and M2 of three *Parasminthus'* species may demonstrate that Clantatal fauna is older than that of Gansu in gelogical age, being of middle Oligocene as shown by other fossils (Huang, 1982).

3. The possible phylogeny of the Ulantatal zapodids

So far known the earliest zapodid was found in the Late Eocene in Yuanqu Basin, Shanxi China.

During the Early Oligocene zapodids hav already diverged greatly, appearing three genera (Wang, 1985). Among these *Allosminthus* is ratner specialized, with large cusps and lower crests, and undeveloped mesoloph and mesolophid. *Sinosminthus* resembles *Parasminthus*, especially the two bigger species, of Middle and Late Oligocene in many respects. They possess relatively large size, no groove on the anterior wall of the upper incisor. In some specimens of *Parasminthus,* the metaloph of M1 links with posteroloph or posterior arm of the hypocone, and M2 has two protolophs, which are the same as those of *Sinosminthus. Sinosminthus,* however, differs from *Parasminthus* in having two protolophs on M1, only three roots in each of the first two upper molars, and less lophodont cheek teeth. These differences indicate that *Sinosminthus* is more primitive than *Parasminthus* and may be the ancestor of the latter. *Gobiosminthus* is closer to *Sinosminthus* than to other forms of the Early Oligocene zapodids. They possess relatively big size, relatively strong lophodont crests and metaloph of M1 connecting with posteroloph. Nevertheless, the difference is big enough to separate the two genera. In *Gobiosminthus,* the metaloph connects with the posteroloph not only on M1 but also on M2, M2 has protoloph II and no protoloph I and is so similar to M1 that it is really difficult to distinguish the two in isolated teeth. Above features, however. show that *Gobiosminthus* may be derived from *Sinosminthus* but is very specialized. *Shamosminthus* is small to medium-sized. The metaloph of M1 connects with posterior arm of the hypocone, which is closer to that of *Sinosminthus* than that of any genera else among the Early Oligocene zapodids. But *Shamosminthus* possesses large mesocone, short mesoloph, longitudinal crest between the metaloph and posteroloph on M^1. having protoloph II and no protoloph I on M2 All above features differ from those of not only *Sinosminthus* but also other forms. *Shamosminthus* may be a branch of the *SinosminthusParasminthus* lineage in Middle Oliyocene.

Before the discovery of Ulantatal's Zapodils, *Parasminthus* was only found in Gansu. *P. parvulus* differs from the other two bigger species in tooth morphology and shows some features of *Heosminthus*. About the systematic position of this species. Wang (1985) made two possipilities, belonging to *Sinosminthus-Parasminthus lineage* or to *Heosminthus-Plesiosminthus* one, and finally thought it was suitable to put ii in the former lineage. The reason for this was the morphology of the lower molar and four roots of each of M1 and M2. The material of *P. parvulus* from Ulantatal, in some specimens M1 or M2 having there roots and the lower molars like m2 possess short metalophid II besides metalophid I which seem to increase the relationships between this species and *Heosminthus*. On the other hand, the tooth morphology of the two bigger *Paasminthus* species is not as simple as thought before. Their metacone of M1 in some specimens links with certral side of hypocone, and M2 possess only one protoloph in most of specimens, which are the typical pattern of the corresponding teeth in *Parasminthus parvulus*. Moreover, it is very difficult to distinguish the tooth that is in he boundary between the two species. That means three species of *Parasminthus* are contiuous or transitional in size. The fact that revealed by, Ulantatal material indicates that it should maintain *P. parvulus* in the genus of

Parasminthus.

图 版 说 明

(所有标本均约×20)

图 版 I

中亚副蹶鼠 (***Parasminthus asiae-centralis*** **Bohlin, 1946**)

1.左 M^1(V10136.2,7b); 2.左 M^1(V10133.12,4b); 3.左 M^2(V10132.6,4a); 4.左 M^2(V10133.24, 4b); 5.右 P^4(V10133.2,4b); 6.左 M^3(V10133.28,4b); 7.左 M^3(V10133.34, 4b); 8.左 M_1(V 10133.43,4b); 9.左 M_1(V10133.45,4b); 10.左 M_2(V10135.14,7a); 11.左 M_2(V10136.23, 7b); 12.左 M_2(V10133.51,4b); 13.右 M_2(V10133.60, 4b); 14.左 M_2(V10133.62, 4b); 15.左 M_3(V 10133.64,4b)。

图 版 II

1—2.中亚副蹶鼠 (***Parasminthus asiae-centralis*** **Bohlin, 1946**)

1.左 M_3(V10133.66,4b); 2.左 M_3(V10133.67,4b)。

3.?戈壁蹶鼠未定种 (**?*Gobiosminthus* sp.**)

左 M^2(V10310.1,46)。

4.邱氏戈壁蹶鼠(新属新种) (***Gobiosminthus qiui*** **gen. et sp. nov.**)

右上颌骨残段附 M^1-M^3(V10167,7a, 正型标本)。

5.童氏沙漠蹶鼠(新属新种) (***Shamosminthustongi*** **gen. et sp. nov.**)

左上颌骨残段附 P^4 M^3(V10315,8b, 正型标本); 6.左 M^1(V10314.8,4b)。

图 版 III

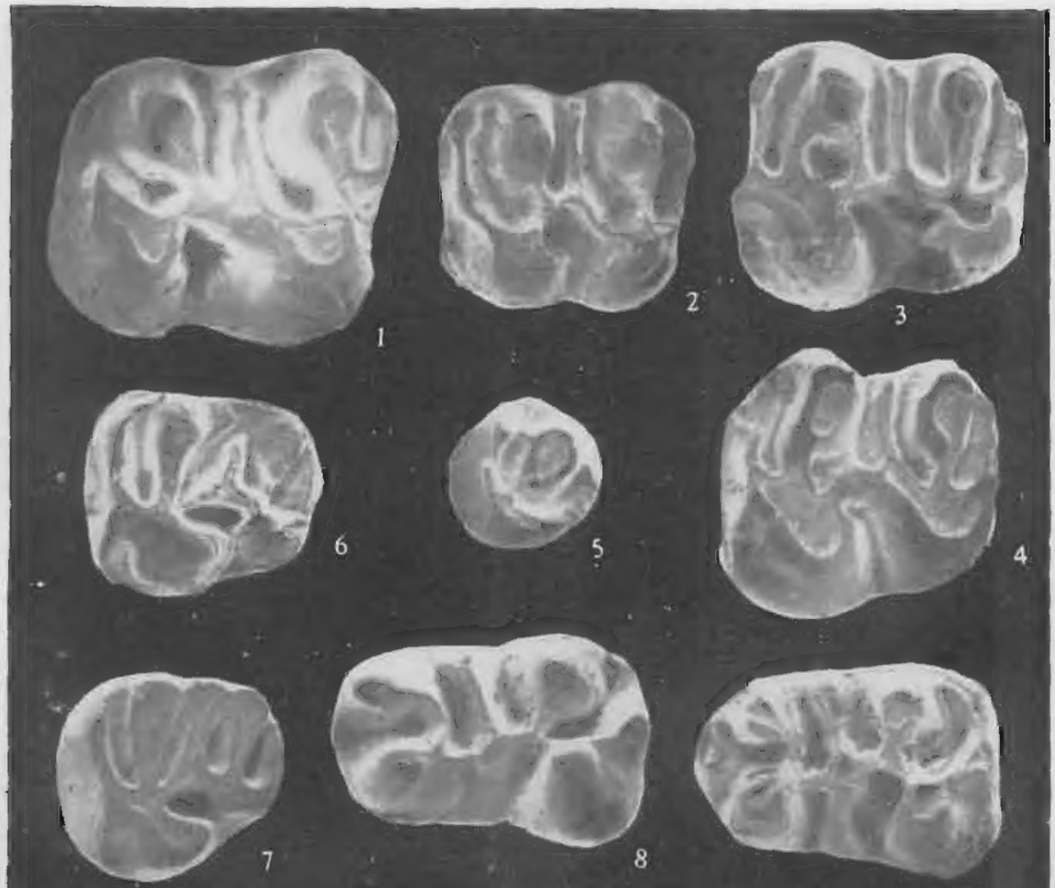
党河副蹶鼠 (***Parasminthus tangingoli*** **Bohlin, 1946**)

1.右上颌骨残段附 P^4-M^2(V10152;4a); 2.右 M^1(V10153.108,4b); 3.左 M^2(V10153.236,4b); 4.左 M^2(V10153.197,4b); 5.右 M^3(V10153.244,4b); 6.右 M^3(V10153.247, 4b); 7.残破的右下颌骨附 M_1-M_3(V10153.6, 4b); 8. 左 M_1(V10153.303, 4b); 9. 左 M_1(V10153.321, 4b); 10. 左 M_2(V10153.444,4b); 11.左M_2(V10153.464,4b); 12.左M_2(V10152.194,4a); 13.左M_2(V10155.59, 7a); 14.左 M_3(V10153.516,4b); 15.左 M_3(V10153.523,4b)。

图 版 IV

小副蹶鼠 (***Parasminthus parvulus*** **Bohlin, 1946**)

1. 右 P^4(V10160.25, 4b); 2. 左 M^1 (V10160.216, 4b); 3. 左 M^1 (V10163.31, 7b); 4. 左 M^2(V10160.368,4b); 5.左 M^2(V10159.98,4a); 6.左 M^3(V10160.394,4b); 7.左 M^3(V10160.400, 4b); 8. 左 M_1(V10160.563,4b); 9.左 M_2(V10160.714,4b); 10.左 M_2(V10160.737,4b); 11.左 M_2(V10160.742,4b); 12.左 M_2 (V10160.767,4b); 13.左 M_3(V10160.819,4b)。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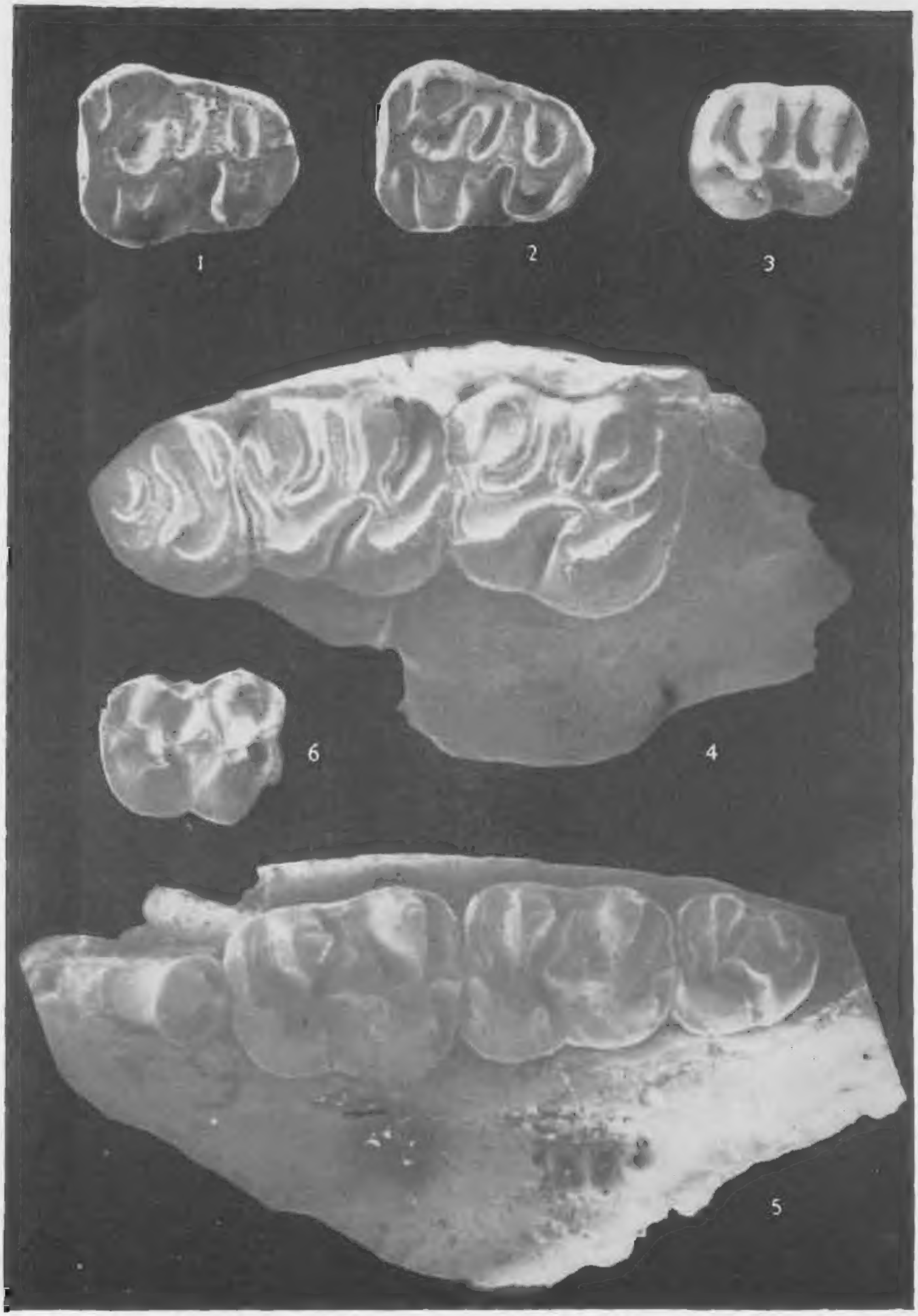
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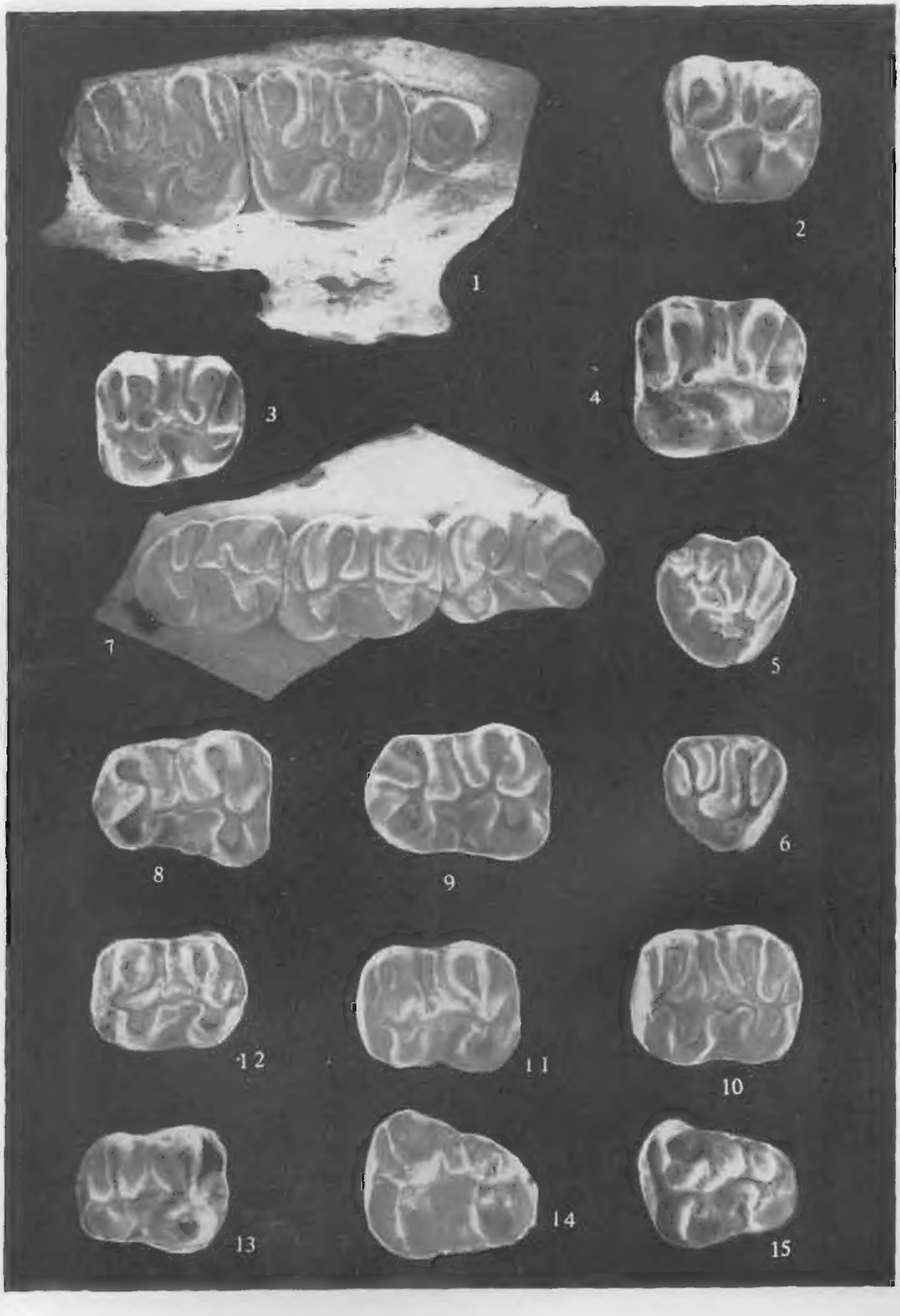
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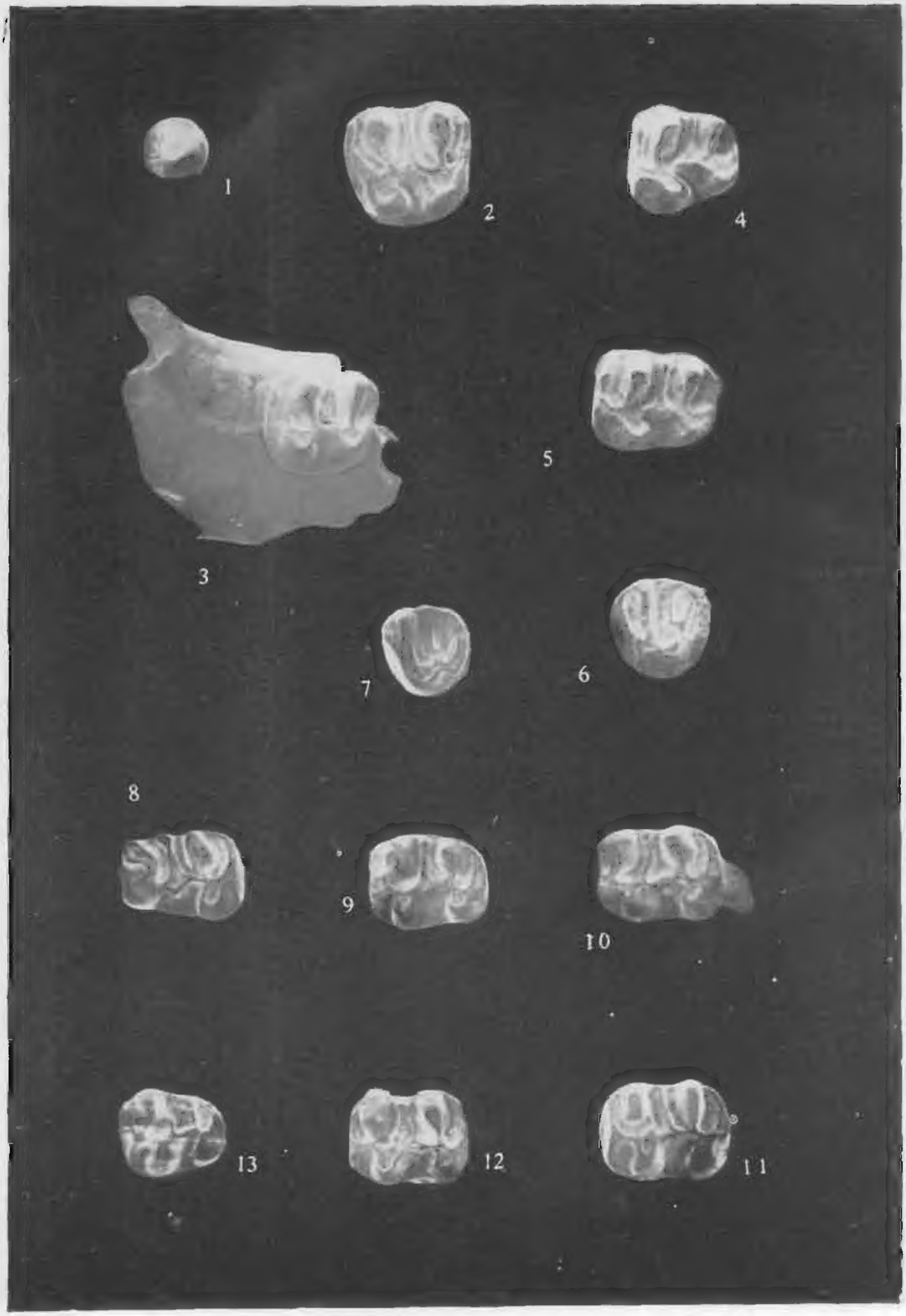
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